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CO_2 Process

For several months, gossip has been heard within the industry of a revolutionary process of core and mould making involving the treatment of a sand with carbon-dioxide gas and indeed we have printed a note* as to its availability. Yet until we read the article on the subject printed elsewhere in this issue we were unable to appraise the significance of the process. Once the underlying chemical equations are appreciated, the potentialities and drawbacks of the method become obvious. Amongst the drawbacks is the fact that more generous taper on patterns and coreboxes is necessary because of the phenomenon of expansion of the sand mixture during treatment. When moulding for the CO_2 process, patterns have to be provided with runners, risers and ingates as the mould becomes quite hard and runners, etc., cannot subsequently be cut. Again, the de-coring does not appear to be as easy as with oil sand.

On the other hand, the benefits are promising. Often there is no subsequent drying involved and, if there be, it is of but short duration. The dimensions of a core if initially accurate will be unchanged, even if there be some short subsequent processing, as unsupported handling of the core in the "green" state is eliminated. This, for delicate work, would render superfluous the provision of carriers. To our mind it is making of dry-sand moulds and large cores which have the major potential applications for the new process, as, there, economies can be looked for in fuel reduction; substantial gains in time, and—it would appear—lowered raw material costs. As was the case about six years ago, when we advocated thorough investigation of the "C" process, we see in this new CO_2 process a means of making castings with less handling. In fact, the two ideas might be combined, using the high-strength CO_2/silicate sand to furnish a shell mould of great precision from a cold—and, possibly, wooden—pattern. One phase not covered by the article is sand reclamation and one can only envisage that the presence of increasing proportions of alkali silicates in sands would lower their refractoriness, and the cost of new sand to-day is not a negligible matter. Again, the provision of generous taper may be reflected in increased machining costs.

Any new process open to the foundry industry, has with the passing of time, an increasingly hard row to hoe, because the traditional methods have been so developed that they are now producing under the most economical conditions. The flow of the work and the mechanization of each movement have been so developed that the irreducible cost minima have been reached. Newer processes can only show for a prolonged period "prototype" production costs and this facet should be borne in mind. For instance the description of the CO_2 process tells of the piercing of the moulds for the insertion of the gas-injection tubes, yet it is not beyond the inventive genius of man to design a gadget for doing this operation mechanically. Like all other new processes, this one will find its own particular niche in the foundry industry. Whether it will be large or small, time alone will show. It has, however, every appearance of being a worthwhile process for intelligent practical trial.

*"New Catalogues," JOURNAL, February 25, 1954.

Institute of Vitreous Enamellers

Annual Conference, Manchester, October 7 to 9

The 1954 annual conference of the Institute of Vitreous Enamellers will be held in Manchester from October 7 to 9 inclusive, with headquarters at the Midland Hotel. All members are invited to attend the works visits and technical sessions and those wishing to do so should complete a reply form, and return it, not later than Friday, September 3, to the secretaries. The full programme for members and ladies is given below. Hotel reservations should be made independently as soon as possible. The Institute is indebted to the companies allowing members to inspect their works and it should be noted that the numbers on these visits are strictly limited, and, unless notice is given to the contrary, transfers will be made if one of the visits is completely booked. All applications will be taken in strict rotation as received.

Programme

Thursday, October 7.

9.30 a.m. Annual general meeting, in the Alexandra Room, followed at 10.45 by the presidential address by Sir George Briggs.

11.30 a.m. Technical session "A," in the Alexandra Room; symposium on "Direct Application" by A. W. Murdoch, and B. Zick; additional contributions by Dr. B. K. Niklewski and H. Laithwaite.

1.00 p.m. Luncheon, in the Banqueting Hall (members and ladies).

2.30 p.m. Technical session continued.

7.00 p.m. Reception by the president and Lady Briggs and the chairman of the Council and Mrs. A. Biddulph, in the Banqueting Hall (members and ladies).

7.30 p.m. Annual banquet, followed by dancing until 1.00 a.m.; (members and ladies) (evening dress and decorations).

Friday, October 8.

9.30 a.m. Technical session "B," in the Alexandra Room; symposium on "New Finishes and Materials —A Challenge to the Vitreous-enamelling Industry" by J. Hooper, G. Murray, E. W. B. Dunning, and H. Silman.

12.30 p.m. Luncheon, in the Banqueting Hall (members and ladies).

Works visits; members may participate in one only of the following.

1.30 p.m. (1) Blake Vitreous Enamelling, Limited, Accrington.

2.00 p.m. (2) Ferranti, Limited, Hollinwood.

Coaches will leave from the Midland Hotel promptly at the times given.

7.30 p.m. Dinner and entertainment, in the Grill Room (members and ladies) (informal dress).

Saturday, October 9.

10.00-12.00 noon. Technical session "C." Further discussions; technical and sub-committee reports, and "question box."

Ladies' Programme.

Thursday, October 7.

10.45 a.m. Coffee.

11.30 a.m. Knitting demonstration at Kendal Milne and Company, Deansgate, Manchester, 3.

1.00 p.m. Luncheon, in the Banqueting Hall.

7.00 p.m. Reception by the president and Lady Briggs and the chairman of Council and Mrs. A. Biddulph, in the Banqueting Hall.

7.30 p.m. Annual banquet in the Banqueting Hall, followed by dancing until 1.00 a.m.

Friday, October 8.

12.30 p.m. Luncheon, in the Banqueting Hall.

7.30 p.m. Dinner and entertainment (Grill Room).

Conference Paper Author

J. BERNSTEIN, author of the paper "Modern Production of Whiteheart Malleable Iron" (presented at the Glasgow Conference of the Institute of British Foundrymen) printed on page 169 of this issue was educated at King Edward's Grammar School, Birmingham, and continued his studies at Birmingham College of Technology, gaining the Associateship of that College in 1944. He qualified as an Associate of the Royal Institute of Chemistry in 1944 and as an Associate of the Institution of Metallurgists the following year. He joined the staff of the B.C.I.R.A. in 1938 and was engaged on various studies of cast iron. In 1950 he joined the Simplex Electric Company, Limited, and was appointed foundry manager and chief metallurgist six months later. In 1952 Mr. Bernstein was promoted to the position of works manager of the Oldbury factory and foundry.

He has presented several papers on the vitreous enamelling of cast iron, and the gaseous annealing of whiteheart malleable iron, in addition to other papers. He is a member of many technical associations and serves on the Cast Iron Sub-committee of the Institute of Vitreous Enamellers.

Works Visit Offer

Wild-Barfield Electric Furnaces, Limited, Elecfurn Works, Watford By-Pass, Watford, Herts., announce that they will be pleased to welcome parties of up to 30 senior students from technical colleges and members of technical societies to the Watford Works, where an interesting and extensive tour is arranged. The tour includes a visit to the production shops, where electric furnaces from laboratory units to full-scale production furnaces and induction-heating equipment will be seen in all stages of manufacture. The metallurgical and chemical laboratories provide opportunity for the study of research methods and equipment, whilst the development section affords the visitor scope for seeing many new heat-treatment processes and prototypes in the course of development. An invitation is extended to parties of visitors from September 1 to May 31, 1955, on a limited number of weekday afternoons (Monday to Friday) and early application is desirable.

Next Year's B.I.F.

The emphasis of the 1955 British Industries Fair, to be held at Olympia, London, and Castle Bromwich, Birmingham, from May 2 to 13, will be on goods for both home and export, and not almost exclusively on exports as in recent years, according to an announcement by Sir Ernest Goodale, chairman of British Industries Fair, Limited. The concentration of the London section of the B.I.F. at Olympia is part of the new company's policy of providing in London a better planned display, differing somewhat from previous years, when the section was divided between Earls Court and Olympia.

Modern Production of Whiteheart Malleable Iron*

By Jeffrey Bernstein, A.R.I.C., A.I.M., A.C.T.(Birm.)

The Paper briefly describes the changeover from a standard range of castings $\frac{3}{32}$ in. to 1 in thick, weighing from 7 gm. to 14 lb. and annealed in ore in a coal-fired furnace to a wider range and increased output of malleable-iron castings weighing from 7 gm. to over 4 cwt. annealed in controlled-atmosphere electrically-heated furnaces. By the application of technical control, it has been found possible to reduce annealing times by changing the form of distribution of carbon in the thicker castings rather than by attempting advanced decarburization. Mechanical properties complying with the requirements of the appropriate British Standards Specifications are attainable by this method.

Production Plant

In the production plant, a pallet conveyor surrounds four pairs of plain-squeeze magnetic moulding machines. The completed moulds are closed on side tracks of roller conveyor and pushed on to the moving conveyor where they are weighted before pouring. This machine section caters for the majority of the long-run jobs, while shorter runs are dealt with by five "home-made" stump moulding machines fitted with vibrators, and three stump-moulding benches. Two bench moulders and one floor moulder cope with the loose-pattern work and heavy castings. The stump work is moulded in wooden snap-flasks and is cast on a roller conveyor. In isolated cases, moulds have been made on roll-over type machines attached to one of the grey-iron sections of the foundry and carried to the malleable section for casting.

Facing sand, prepared in a batch-type mill, is wheeled to the moulders, while backing sand is hopper fed to all machine and stump moulders. The use of facing sand is imperative in order to obtain a fine casting skin from which the sand is easily removed by mechanized cleaning prior to first inspection. The facing sand is made up of 20 per cent. red sand, an addition of 3 per cent. superfine coal-dust and the remainder is backing sand returned from the mechanical sand plant. The backing sand passes through a magnetic separator before despatch to the facing sand mill, thus avoiding the necessity for manually feeding this sand through the magnetic separator attached to the facing mill. The moisture content of the facing sand is controlled between 4.5 and 5.5 per cent. and that of the backing sand between 4.0 and 4.5 per cent. The green-strength of the facing and backing sands is 9.5 to 10.5 lb. per sq. in. and 7.5 to 8.5 lb. per sq. in. respectively, accompanied by A.F.S. permeability numbers of 30 and 40. The temperature of the backing sand in the mechanical plant becomes too high during the day to permit the use of this sand without cool facing sand. Laboratory checks on the sand are taken throughout the day, in addition to moisture checks carried out by the chargehand. Used sand from the stump moulders passes into the same sand system serving the machine and stump moulders, while all used sand from the bench and floor moulders is kept separate. No attempt is made to remove burned cores which pass down the knock-out grating through a disintegrator and magnetic separator into the sand system.

Moulding teams consist of three or four men according to the amount of coring required and the mould production ranges from 500 moulds per day containing up to 24 cores, to 900 moulds per day containing only 2 cores per mould. Cast-iron boxes 3, 4 and 5 in. deep, with loose pins, are used on the machine section. The pins 0.875 and 1.000 in. diameter are regularly checked and are replaced when more than 0.005 in. of wear is detected. The moulding boxes are re-bushed when they show the same degree of wear and fractured or twisted boxes are immediately withdrawn from service. The cast-iron moulding boxes are made and maintained on the premises. A high standard of maintenance is called for on the production plant, the patternshop being responsible for setting of machines, patterns and boxes, but all repairs other than to patterns are the responsibility of the maintenance department.

Patterns

The pattern equipment used on the machines is primarily of brass and iron set in cast-iron plates; both patterns and plates being made on the premises. The maximum size of plate is 20 by 13 in., and this is described as a full plate. Half plates and quarter plates are made up so that four different types of pattern may be in use on the same machine at the same time, and when different numbers off are required, one or more of the quarter plates may be removed or replaced by another. The plates are accurately located by dowel pins in hardened-steel bushes and changeover may be effected in five minutes. Production is planned so that, whenever possible, pattern changes coincide with break periods, so that production time is not wasted. In some cases where balanced numbers off are required and the total numbers off do not justify multiple patterns on a single patternplate, mixed plates are made up and examples of these are shown in Fig. 1. The patterns are heated by

*Paper presented at the fifty-first annual meeting of the Institute of British Foundrymen in Glasgow.

FIG. 1.—*Three examples of "mixed" patternplates, each* 13 *by* 10 *in.*

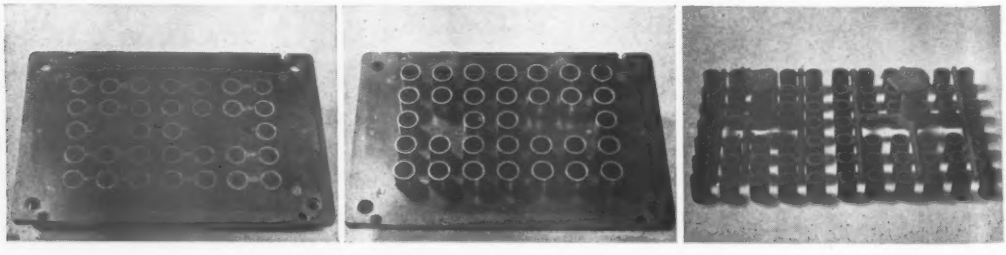
thermostatically-controlled electric heaters fitted below the patternplates. The use of parting media is allowed in special circumstances only; good "lifts" being obtained by maintaining a high degree of polish on the patterns which are well rubbed with plumbago and maintained at approximately 40 deg. C. by means of the heaters.

A wide range of coupler castings is made on what are referred to as stripping-plates. The patterns for these consist of a number of accurately machined and tapered brass tubes fixed by means of collars on to the stripping plate. Facing sand is liberally used in moulding from these plates and after completion of the squeeze the patterns are withdrawn through the stripping plate, leaving the tube impressions in the half mould which is then lifted off and turned over to form the drag. The cope is made on a separate machine and contains the runner bar and ingates. A typical stripping plate is shown in Figs. 2 and 3 and a cast spray in Fig. 4. The smallest casting made in this manner is the ¼-in. coupler and 72 are obtained per mould, the largest being 2 in. internal diameter, with 15 in a mould. For sizes smaller than ¾ in. cores are necessary, as the green-strength of the sand is insufficient to permit this method of moulding. It is of interest to record that these castings, after annealing, are tapped to British Standards Specification electrical or gas thread without previous boring.

Coreshop

For the malleable foundry section alone, it may be necessary to provide 24,000 cores per day and these are prepared in oil-bonded silica sand. Several core-mixtures are used, dependant upon the type and size of core and whether the cores are bench or machine made. The general principle is to produce a sand with the minimum green-sand strength necessary to permit handling and prevent distortion, coupled with a relatively high dry-(skin) hardness and having ready collapsibility. The last-named property is of the greatest importance, as the chemical composition of the iron used is very susceptible to hot cracking and tearing and this is aggravated if there is any restriction to its shrinkage during cooling. On the larger castings, of wall thickness ⅛ in., having cores approximately 9 by 5 by 2½ in., it has been found profitable to pack the centre of the cores with ordinary green-sand, and in other cases a form of shell core has been found

FIGS. 2 AND 3.—*Stripping plate for couplers,* 1 *in. dia.; in the "flush" and "raised" positions; and* FIG. 4.—*Cast spray of couplers* ¼ *in. dia., made from a stripping-plate pattern.*



necessary. Some of the cores may be liberally "nailed" and "wired." As all nails and wires are rejected by the magnetic separator on the moulding-sand plant, they are sorted from the scrap, flash and small castings by a female operator and used again.

Two oil-fired core stoves, operating at different temperatures and speeds according to the type of core and core-sand mixture, are fed by steel-band conveyors to avoid vibration and consequent distortion. After baking, the cores are loaded on to a roller conveyor and fed to side roller tracks for inspection, rubbing or blacking, and are then transferred from trays into pans on to another conveyor and away to the core stores, a view of which is shown in Fig. 5. The core sizes for malleable castings range from ¼-in. dia. by 1 in. long to 3½-in. dia. by 36 in. long and their weights (including cores for grey-iron castings) range from approximately 1 oz. to 214 lb.

Melting

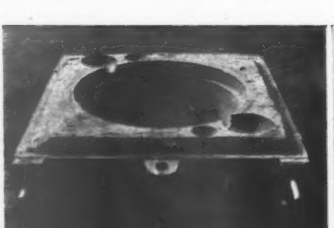
Twin, balanced-blast cupolas, lined down to 27-in. dia., comprise the foundry melting equipment, which is served by an electric lift, conveying the burden to the charging platform to be weighed prior to hand charging. The cupola bottom is laid and made up for lighting at the end of each day and is lighted at 4 a.m. the following day by the man in charge of night-time annealing. The cupola chargehand lays the bed at 6.45 a.m. and charging commences at 7.15 a.m. The first mould is poured at approximately 8.5 a.m. each day. Whatever the charges scheduled for the day, the first six charges contain a decreasing amount of steel scrap, in order to offset the high carbon pick-up off the "fresh" bed. This procedure is followed at midday, when tapping is suspended for 30 min., by the addition of steel to the first six charges after blowing down. The steel is added in place of an equal weight of white-iron scrap, which is of higher carbon content than the pig-iron.

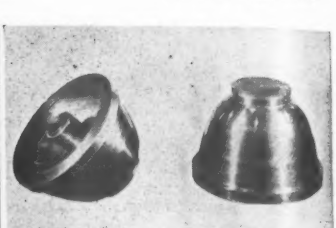
Between 72 and 80 charges, each of 400 lb., are melted daily. The composition of the charge is altered according to the type of work being cast, and several charges of different composition may be melted in between the standard charges for the day, to coincide with the time that a particular mould or group of moulds is ready for pouring. The standard charges are made up of so-called refined-malleable pig-iron and white-iron scrap, or hematite pig, selected mild-steel scrap and white-iron scrap. This may be altered by the further addition of selected steel or up to 10 lb. per charge of malleable iron scrap from the machine shop or annealing shop. Should it be required to raise the silicon content of the iron, this is done by the addition of hematite pig containing 2.5 per cent. silicon in preference to the addition of ferro-silicon.

Selected coke is used in the cupolas for malleable iron at a metal:coke ratio of approximately 7:1, but may be varied according to such requirements as slower melting or higher temperature. At a time when inferior coke was necessarily being used, the sulphur content of the iron was lowered, in the first instance, by the addition of sodium-carbonate blocks to the burden. This was effective in reducing the sulphur, but tended to render the slag difficult to control. At this particular time, the items being cast were of a thinner-section type, and it was found preferable to add ferro-manganese during charging. This was included in sufficient quantity to yield a Mn:S ratio of 2:1 and the satisfactory results obtained from annealing this material has justified the continuation of this practice whenever necessary. The cupolas are blown with an open slag-hole. The iron is ordered in the form of a pig which is relatively easy to break, so that accurate weighing of charges can be achieved. Pieces of pig-iron difficult to break, spilled iron and the accumulated reject iron each day are returned to the cupolas for the last two charges of the day.

The molten metal is tapped into preheated 300-lb. shank ladles and transferred, after skimming, to preheated hand-ladles, each holding about 30 lb. The casting station is approximately 20 ft. from the cupola spout, thus permitting relatively little drop of temperature from tapping to casting. The iron is poured as near to 1,400 deg. C. as possible. This temperature is necessary to facilitate the running of some of the thin-section castings, which would otherwise misrun, at the chemical composition employed. The cupola charges are determined by the laboratory staff and alternatives to the specified charges are permitted only after consultation between the laboratory and the foreman of the malleable-iron section. Control analyses are taken during the day at regular intervals, extra samples being taken when heavy or special castings are made. Test-bars, 2-in. dia., are cast throughout the day for examination of the fracture and a measure of control on the 2-in. dia. test-bars serves as a measure of quality when used in conjunction with the chemical analyses. The degree of mottle in the white-iron bar gives a preliminary guide to

FIG. 5.—*Section of the core stores, illustrating the method of storage in work pans.*





FIGS. 6 AND 7.—*Mould for the spinning-tool casting. The weight of this casting is* 4 *cwt. and its maximum thickness* 8 *in.* FIG. 8.—*Spinning tools after machining; each finished tool weighs approx.* 3 *cwt.*

the progress of altered charges in the cupola, and is also used as a check against consistency in melting. Standard test-bars are cast at the same time as those castings which must meet British Standards requirements; the test-bars and castings being annealed side by side. The appearance of the fracture of the 2-in. dia. test-bar is described in terms of hardness, and it is possible to detect different founding properties in a test-bar having a completely white fracture. As an example, it may be quoted that a silvery-white fracture (no mottle) showing radial dendrites will run thin sections satisfactorily, while a yellow-tinged, white fracture (no mottle) having an apparently spheroidal, cellular structure will tend to misrun and "tear."

Iron Control

The charges are based on standard figures for a particular section thickness and these are based on chemical compositions which will yield the required properties in the material, after a specified annealing cycle. The pig-irons used are ordered to specification to ensure, as far as is possible, consistency in charging. The charges consist of 40 to 50 per cent. pig-iron, 50 to 55 per cent. white-iron scrap returns, and nil to 5 per cent. steel scrap. On certain occasions when it is required slightly to reduce the carbon content of the iron with no desired change in silicon, up to 3 per cent. annealed scrap may be added to the charges. The composition aimed for—and hence the cupola charges—are varied according to the thickness and type of casting being produced. The only element considered on its own is phosphorus, and this is maintained below 0.1 per cent., the remaining elements being considered in their recognized metallurgical pairings, *i.e.*, carbon with silicon and manganese with sulphur. Table I indicates the range of compositions employed for different casting thicknesses:—

TABLE I.—*Metal Composition related to Section Thickness.*

Thickness of casting.	Carbon plus silicon (per cent.).	Sulphur plus manganese (per cent.).	Ratio $\frac{Mn}{S}$
Up to $\frac{7}{16}$ in. ..	4.0 to 4.1	0.50 to 0.58	1.9 to 2.0
$\frac{7}{16}$ in. to $\frac{1}{2}$ in. ..	3.9 to 4.0	0.50 to 0.54	1.8 to 1.9
$\frac{1}{2}\frac{5}{6}$ in. to 2 in. ..	3.7 to 3.8	0.46 to 0.50	1.8
Above 2 in. ..	Max. 3.6	0.44 to 0.48	1.8

The figures shown in Table I cover a tolerably wide range of iron compositions, but the conditions of production somewhat reduce the possible variations due to the constants which obtain. This may be understood, when it is explained that with a balanced programme of castings required over a fixed period and with approximately the same number of moulds cast per day, the same charges and rate of melting may be employed throughout this period, resulting in the achievement of stable analytical figures. The factors which throw the iron off standard are not so much variations in raw materials, for these are blended during charging, but mechanical interruptions such as pattern breakdown or plant failures which interrupt moulding with the consequent necessity of reducing the rate of melting. To minimize this, when it appears that the breakdown is likely to be only of a few minutes duration, melting is allowed to continue at the same rate and one or perhaps more tappings from the cupola may be cast into pig moulds.

Heavy Castings

The castings up to 8 in. thick may receive a ladle addition of heated steel rather than the total required amount of steel in the charge. This is found to give less mottle in the thickest section than if the steel were in the charge. Most of the thicker type of castings of between 2 and 4 cwt. in weight have been found to contain some mottle in the thicker sections, due primarily to the effects of slow cooling. In view of the great shrinkage which occurs during the solidification of this type of casting, a very heavy riser is used and this is topped-up with hot iron during casting.

The properties required from these heavy castings are resistance to shock, good machinability and ability to produce a surface of high polish; they are used for the production of spinnings of up to 2 ft. dia. in steel, copper or aluminium. The sections of the finished spinning chucks are considerably less than the casting thickness, but adequate machining allowance is provided so that perfect balance after machining is assured. Figs. 6 and 7 illustrate a mould for a heavy casting with an 8 in. section and it will be seen that the sand joint is cut away inside the cope to withstand the tendency for bursting out. Fig. 8 illustrates two of the heavy castings after machining.

Patterns for heavy castings of this type are strickled in stone plaster and after drying are heavily varnished with shellac. After the machined castings have been tried out and approved, the patterns are destroyed, only the template used for strickling the plaster being retained in case of a further order for the same casting.

Fig. 9, 10 and 11 illustrate a representative range of castings made in whiteheart malleable iron, and are selected out of those produced from some 4,000 patterns.

Production Control

All orders for castings are filed for future reference, after the appropriate details have been transferred to a separate card-index system which describes the pattern equipment, type of core and weight of each casting. There is a card for each type of casting and from this it is possible to tell the dates and numbers of the orders, the total number of castings made, scrapped, delivered and outstanding at the particular date of the enquiry. The information for the cards is obtained from the departmental returns and the despatch tickets and is cross-checked against inspection reports.

Yearly planning is based on four periods each of three months duration and an assessment is made of any spare capacity by the transfer on to loading charts of the numbers required of each casting. Provision is made for rush orders and on the loading charts spaces are left midway through each period to enable arrears to be made up, or for work which is planned for later production to be brought forward. From the loading charts it is possible to determine what patterns will be in work at a date up to twelve weeks ahead and on which machine those castings will be made. This system permits of similar production planning in the machining factory which takes the bulk of the malleable castings.

When all the details of orders have been duly entered and assessed, the production-control department issue weekly programmes which are sent to the coreshop, patternshop and moulding sections. The patternshop and coreshop receive these programmes one week ahead of the moulding sections, so that patterns and coreboxes can be checked before going into work. In some cases, it is necessary to give the coreshop more than one week's notice for instance, for the production of cores which are consumed faster than they can be produced. The production-control department advise the dressing and annealing sections of castings required urgently, otherwise everything is dealt with cast by cast. Each day's production is recorded in detail and is compared with the performance of other days when the same jobs were in production. The number of cores made and used, the number of charges melted, number of shank ladles of iron poured and rejected, number of moulds made and number of castings good and bad are all cross-checked, as on the figures so obtained, production is controlled and wages are paid.

Every casting after knocking-out is cleaned in a Tumblast unit before being passed to female operators for chipping and viewing. This constitutes the second stage of batch inspection but is the first 100 per cent. inspection. All rejected castings are re-examined and classified under one or more of 14 categories and the numerical totals and weights are recorded. Where inspection classifies rejects such as due to "bad core-laying," "crush," "sand inclusions," etc., these are listed as moulders' faults. Similarly rejects for "misrun," "slag inclusions,"

FIG. 9.—*Range of light, malleable castings from* $\frac{1}{4}$ *in. dia. by* $1\frac{1}{4}$ *in. long to* 3 *in. dia.* 36 *in. long, with thicknesses of* $\frac{3}{32}$ *to* $\frac{1}{2}$ *in.*

FIG. 10.—*Examples of medium-size castings, up to 2 in. thick.*

etc., are regarded as the responsibility of the casters. Of the categories listed, misrun castings are perhaps the most difficult accurately to allocate, as metal composition may be the cause of misrunning and hence the caster cannot be held responsible.

From the chipping and viewing section, the weighed and counted castings pass to the fettlers and after a check of the weights are forwarded to the annealing shop. Certain castings are fettled after annealing, as it has been found that in some cases the castings become highly stressed locally during dressing and are then found to be cracked after annealing. After annealing, every casting is again inspected and the examined castings are weighed and counted (by computation for small castings) and batch tickets accompany the items, which are then despatched in steel pans. Three different sizes of steel pans are used for the handling of the castings from knock-out to despatch, as it is easier then to assess the progress of the work.

The production-control department is responsible for checking all figures in order to determine whether further castings are required to complete orders and also for ensuring that credit is obtained for all work despatched whether to an inter-factory order or to an outside customer. The production-study department is responsible for checking a copy of the same figures for payment purposes. All operators, except the skilled inspectors (who receive fixed rates according to their ability), are paid on and incentive system.

Each day's cast is kept separate, even though the same castings may be produced on successive days, but variance from routine may be sanctioned by the production-control staff under special circumstances. An important part of the function of production control is to ensure that the programme of castings called for is an arranged proportion of cored and non-cored items. This ensures that the coreshop does not receive an excessive demand for cores and that the annealing shop is not embarrassed by a large quantity of small, flat castings all requiring to be treated at the same time.

Inspection

Patrol inspection staff cover the moulding sections during production, sample sprays of castings being taken from the knock-out at regular intervals during the day. Without waiting for complete cooling, the castings are shot-blasted and checked. Sprays of castings complete with runners are taken, so that each pattern on a patternplate can be checked, while at the same time the efficiency of spinners, feeders and slag traps can be observed. Plug gauges are used to check all apertures on the castings, when complete cooling has taken place. Should cross-joint castings, off-size apertures or any similar defects be met, the patrol inspector supervises the making of a further mould, which is then marked. He checks the cores, etc., and inspects the castings produced. If the castings are again faulty, further production is suspended until the fault is corrected.

The next stage of inspection occurs during the removal of flash, when every casting is handled. Eight operators are required to complete this inspection and a further two inspectors are required to examine for a second time all items that are rejected. The work rejected may not actually be

scrapped, but the operators are required to reject rather than pass any castings about which they may be doubtful or which may require additional dressing. Scrapped castings are analysed as previously described, and a copy of the analysis sheet is examined by the laboratory staff.

Patrol inspection staff follow the castings during dressing, and a further inspection takes place during the loading of the annealing furnaces. The loaders must not load any defective casting or any casting which is badly fettled. After annealing, every casting is again inspected, primarily for distortion and splitting but also for surface condition, as it sometimes does occur that on a satisfactorily-annealed charge a few castings show surface defects such as patches of scale or a form of slag which may result from fusion of a part of the casting on to the hearth of the bogie. All distorted and split castings are kept separately, the distorted ones being set either by hand or on presses, re-examined and then returned. An analysis is kept of all split castings and note is made of the position on the castings of any splits or "tears." The numerical analysis is required by the production-control section and the detailed analysis is dealt with by the laboratory staff who, from the statistical information obtained, have been able in a number of cases to prevent recurrence of this form of defect by slight modification to the castings or by altering the core-sand mixture. Inspection figures are reported daily and a weekly summary is prepared for departmental circulation.

Annealing

The annealing equipment consists of two electrically-operated, controlled-atmosphere furnaces, each of 5-tons nominal capacity and in this Paper they will be referred to as No. 1 and No. 2 furnaces. The No. 2 furnace which has annealed 1,300 tons of castings in just over two years is of more recent design than No. 1, which has completed more than five-years' service and annealed some 3,500 tons. The earlier furnace has two cooling chambers and is generally of more robust construction than its successor. The No. 2 furnace (which has one cooling chamber) can, however, be cooled more rapidly than No. 1, and for this reason has been found to be a more successful unit for annealing the very heavy castings. The two furnaces are installed in parallel, and, though having separate control units, they are controlled from a common instrument platform.

Programmes are issued to the annealing section in a different form from that in which programmes are issued to other sections. They are prepared in conjunction with production-control staff but are more concerned with the segregation of castings of different section thickness and planning annealing cycles to fit in with such factors as loading and unloading on week-days; avoiding the heating-up and cooling-down of both furnaces at the same time, and (during the winter months) ensuring that the furnaces are not switched on to their maximum power rating during normal factory working hours.

The furnaces are in operation 168 hours each per week and are under supervision for the whole of this time. The total output in tons from these furnaces will, of course, vary according to the type of casting being annealed, but when the whole range of castings illustrated in Fig. 9 and 10 is in production, the average weekly output from the two furnaces is of the order of 30 tons. Recently, during a complete overhaul of No. 1 furnace, 20 tons of annealed castings made up of 4 cycles of 43 hours, were obtained in 172 hours from the No. 2 furnace. It is possible to achieve higher figures than those quoted above, but it has been found that if an attempt be made to increase the load on the bogies at the

FIG. 11.—*Heavy castings produced in the same organization; these have a maximum thickness of 6 in.*

Modern Production of Whiteheart

expense of careful packing, the quality of the castings will suffer.

As is well known, the main reaction occurring during the operation of these furnaces is the reaction between carbon at the surface of the castings and the circulating atmosphere in the furnace, and it is therefore of paramount importance that the castings be loaded in such a way that all castings will have access to the reacting gases. The castings are loaded in eight main sections, each section being four tiers high. The sections are again sub-divided, so that the load is broken into 56 portions as illustrated in Fig. 12.

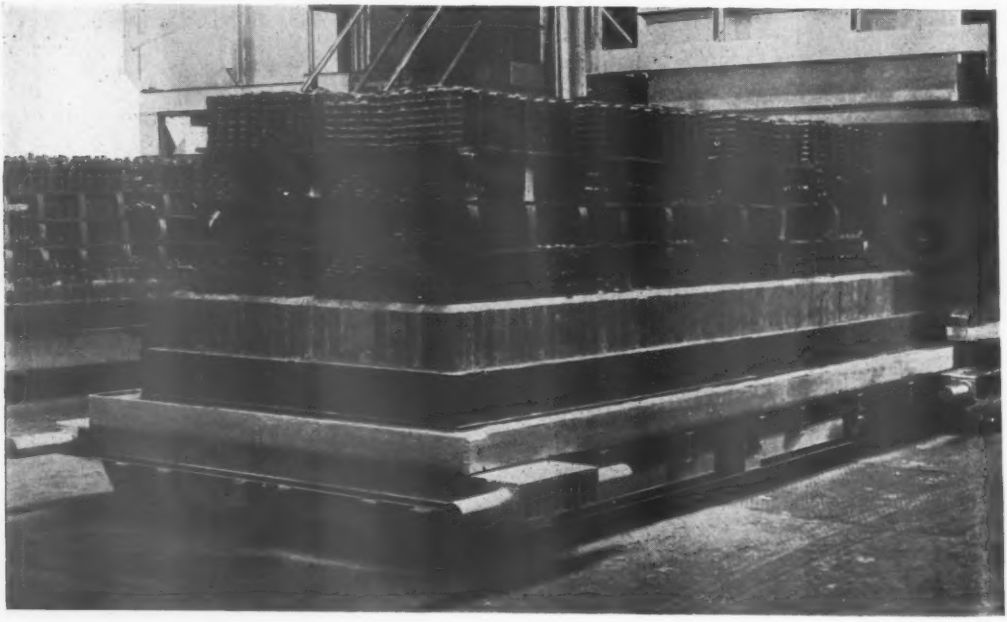
The annealing section is staffed by a total of 12 men and women; six female loaders assisted by one furnaceman are responsible for all loading and unloading, two female inspectors cater for all inspection and one man deals with the distorted castings. On the day-shift, there are two furnacemen, the relief night furnaceman and the departmental chargehand. The duties of the latter include the weighing of all castings, in addition to supervision of the loading and control of the furnaces. The chargehand is required to take a turn of night-duty, first to relieve the regular night furnaceman and secondly to ensure that all furnacemen become familiar with the whole procedure of the section, so that in case of absenteeism, trained relief is always available. The general procedure of the department is organized to deal with about 22 tons per week of castings below $\frac{3}{16}$ in. section, approximately 5 tons between $\frac{3}{16}$ in. and $\frac{1}{4}$ in. and up to 5 tons above $\frac{1}{4}$ in. thick.

For castings up to $\frac{13}{16}$-in. section, the time cycle is 44 hrs., made up of 7 hrs.' heating up to 1,050 deg. C., 30 hrs. at temperature and 7 hrs.' cooling down to 400 deg. C. The bogie is never removed from the furnace until the three temperature indicators read below 400 deg. C. For castings between $\frac{1}{4}$ in. and $\frac{3}{4}$ in. two types of annealing cycle may be employed according to the rôle which the casting has to fulfil.

If maximum ductility be required, and hence advanced decarburization, soaking times up to 50 hrs. followed by fast cooling may be employed. On the other hand, should ease of machinability be more important than high elongation, the soaking period may be reduced to 36 or 42 hrs., followed by a controlled, slow cool. In actual fact, there may be no saving of time compared with the soaking period of 50 hrs., as the extra time may be utilized during cooling, dependent, of course, upon the character of the castings, but there is economy in the consumption of electricity. Cycle times up to 108 hrs. made up of 8 hrs.' heating, 50 to 70 hrs. at 1,060 deg. C., with varied forms of a spheroidizing cool of between 20 and 30 hrs.' duration, are employed for castings above $\frac{1}{4}$ in.

It is known that the controlling factor in the annealing of whiteheart malleable cast iron is the rate of diffusion of carbon to the surface of the castings and its removal therefrom by the decarburizing atmosphere—which, in electric annealing furnaces, consists initially of a mixture of air and water-vapour. In order, therefore, to effect adequate

FIG. 12.—*Loaded annealing bogie, packed in 56 sections. The total weight of castings is 5 ton 14 cwt.*



decarburization of heavy sections, uneconomically prolonged annealing times would be necessary. In consequence, advantage is taken of the fact that, at the annealing temperatures employed, the carbon is in solid solution in austenite and that rapid cooling from this state to a temperature of approximately 700 deg. C. will promote the precipitation of iron carbide. This will form fine spheroids of cementite in a ferritic matrix, if this temperature is maintained for a period, and then followed by a cooling rate of 5 to 10 deg. C. per hr. for periods from 6 to 15 hrs., according to the type of casting. For metal sections up to 8 in., care must be taken to ensure that the whole of the casting in question responds to the required changes in temperature, and in order to do this without attendant detrimental treatment to other castings on the bogie, it is arranged that the castings are packed to leave channels larger than usual for atmospheric circulation around the heavy castings. By trial, it has been found most successful to complete the load on the bogie with castings which will become almost completely decarburized during the holding period at maximum temperature. Thus castings of $\frac{1}{2}$ to $\frac{3}{4}$ in. thickness and up to 8-in. sections can be annealed together successfully.

To ensure that the centre of the thickest casting falls below 680 deg. C. after the rapid cool from 1,060 deg. C., cooling continues until all three temperature readings are below 610 deg. C. and, as soon as the last of the readings reaches this figure, the furnace is rapidly heated up to 760 deg. C., held at this temperature for 2 hrs., and then allowed to cool at 5 deg. C. per hr. for about 12 hrs. The rate of cooling is gradually increased until a temperature of 650 deg. C. is shown on the temperature recorder, and at this point the maximum cooling rate is continued until 400 deg. C. To check the casting after annealing, a test block of similar thickness is drilled and a specimen is cut for micro-examination. Fig. 13 illustrates the structure at the centre of one of the 2-cwt. castings. The output of castings of from 4- to 8-in. section must necessarily be small from the production equipment described, and in actual fact is about 5 cwt. per week. The required properties of the material are:—High tensile strength, resistance to shock, mirror finish on machining, and ease of machining. It may be of interest to record that the machining department prefer the machining properties of the spheroidized castings, as higher cutting speeds may be employed than when machining castings the structure of which consists of pearlite in ferrite.

The main responsibility for ensuring satisfactory decarburization without scaling attaches to the laboratory staff, who, knowing the chemical composition of the castings, determine the form and length of the annealing cycle and also the quantities of air and water-vapour admitted to the furnaces during annealing. With increasing experience of annealing the same type of castings within a known range of chemical compositions and in the same annealing furnaces, it is found that observation of the velocity and colour of the flame from the burning exhaust gases in conjunction with readings of the carbon-dioxide recorder provides adequate information successfully to control the furnaces. However, should the operating behaviour indicate unusual conditions, meter readings are checked against data from a portable gas-analysis apparatus.

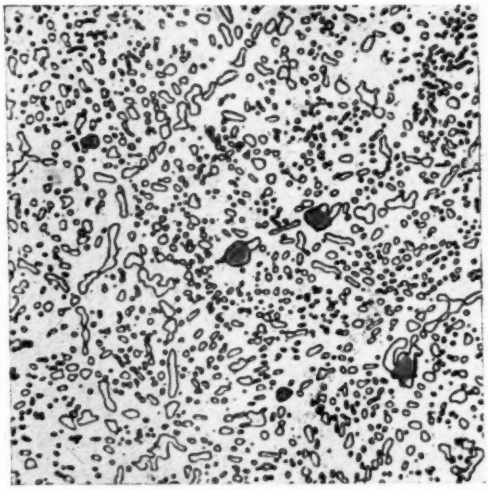


FIG. 13.—*Photomicrograph of the structure at the centre of a heavy section;* × 60.

The normal flame is pale-blue, flecked with yellowish-green flashes and may be described as a "lazy" flame. This type of flame is decarburizing, but does not cause surface oxidation or scaling, whereas a flame of the same colour moving faster indicates that oxidation may result towards the ends of the annealing cycle. As the flame assumes more yellow flashes or, at the extreme, tends towards sodium-yellow with blue streaks, oxidizing or scaling conditions exist in the furnace. An excess of water-vapour or the in-leakage of atmospheric air is easily detected in the exhaust-gas flame, which moves faster and may be described as fierce.

It sometimes occurs that parts only of a load of castings may show slight scale, even though flame conditions and meter readings appear satisfactory. In such cases, a further load is annealed and the same area of the load examined for scale after annealing. Should the scale appear to be of the same order, the gas-tight seals closest to that area are checked. Precautions of this kind being taken when the extent of oxidation could almost be neglected, prevents subsequent interruption of an annealing cycle when the leak in the seal may suddenly worsen, yielding furnace-atmosphere conditions which might necessitate immediate cooling of the charge. Should a muffled bang be heard at any stage during the heating up of the furnaces, extra care is taken in checking furnace conditions and should similar sounds be heard during cooling down, the furnace is cooled right down to room temperature and the cooling chambers examined for non-gas-tight seals. It is possible successfully to operate the furnaces notwithstanding minor leakages, but as these may

FIG. 14.—*Hearth of an annealing bogie after 2 years' service.*

FIG. 15.—*Bogie shown in Fig. 14, after repair with monolithic refractory.*

worsen during an annealing process with risk to the charge, this procedure cannot be recommended.

For most consistent results, with minimum delays in production, a routine maintenance procedure is followed. This comprises the regular cleaning of all air and water-vapour ducts, regular checking and cleaning of all electrical connections and contacts on the control panels, renewal of absorption tubes on the carbon-dioxide recorder and checking of seals and joints. Important, too, is the condition of the bogies. As the brickwork of the bogies becomes worn, through service, the damaged sections are removed and replaced. This may be done more easily by the application of monolithic refractory in place of refractory bricks. Figs. 14 and 15 illustrate a bogie before and after repair. Badly worn brickwork on the bogie prevents loading to capacity and tends to increase the amount of distortion. As the surface of the bogie hearth becomes worn, a compound forms between the scale from the supporting plates and stools and the refractory of the bogie. This compound will fuse on to the surface of castings in contact with it and is extremely difficult to remove. When this first occurs the bogie hearth is covered with steel sheet. Ordinary mild steel sheets have a life of approximately three months under annealing conditions.

The condition of the castings on unloading from the annealing furnace is such that painting can be effected without the need for any form of prior surface preparation. When the castings are to be galvanized, however, it is advisable for them to be "barrelled" prior to pickling.

Contrary to earlier thoughts on the subject, it is now apparent that the limit of economic annealing of whiteheart malleable iron does not occur when the section thickness of the castings is of the order of 1 in. The controlling limit may be that section thickness which, in a whiteheart composition, achieves the desired mechanical properties. A question that would appear to remain is whether a material of 3.25 per cent. total carbon and 0.35 per cent. silicon which is annealed to yield a homogeneous microstructure of finely spheroidized cementite in a matrix of ferrite can, in fact, truly be described as whiteheart malleable cast iron.

Acknowledgment

The Author wishes to express his thanks to the directors of Simplex Electric Company, Limited, for permission to publish this Paper, with illustrations.

Ore or Mineral?

In the course of some contributed remarks to the discussion on a paper entitled "Ore: What is it?" submitted by W. R. Jones, D.Sc., to the Institution of Mining and Metallurgy, Dr. H. P. T. Hyde gave the opinion that the English word "ore" was the plain translation of *erz*, and should be used in the same sense. In its broadest version so far suggested "ore" becomes identical with mineral. If stress is laid on the economic use, a plain mineral turns automatically into ore as soon as science has found a market for it, or ore back into mineral if a better substitute is found.

To Make Gas Turbines

For many years Richardsons Westgarth & Company, Limited, Hartlepool, has manufactured steam turbines, blowers, and other equipment under arrangement with Brown-Boveri, Baden, Switzerland, and it is now announced that the manufacturing agreement with Brown-Boveri has been extended to cover the manufacture of gas turbines for all purposes. Under the agreement Brown-Boveri will make available to Richardsons Westgarth its designs, Patents, and research experience.

Making Cores and Moulds by CO_2 Hardening*

Interim Account of Basic Principles and Progress

The process of making moulds and especially cores usually involves the use of a bond, often an oil, which requires a certain amount of time for drying or for handling and for the majority of methods a more or less prolonged period for stoving. The stoves, the cores being dried, as well as the cores awaiting drying, all occupy substantial space. The new CO_2 process, however, permits of the direct production of a core—by a very simple treatment lasting but a few seconds—which can immediately be set on the mould and cast up.

In the case of batch production of cores it is necessary to have a stock of cores ready for use, which will at least equal a stove load. For continuous core-stoves, this stock is automatically made up by the cores being baked, the quantity of which is determined by the drying cycle. For air-drying cores, a stock is made up of cores still drying and the quantity required is governed by the times necessary for the process used. Moreover, the subsequent operation in coremaking by traditional methods involve quite a number of important routines.

Basic Reactions

The principle of the CO_2 process for core or mould production is based on the following reactions:—

$$Na_2SiO_3 \cdot x\,H_2O + CO_2 \rightarrow Na_2CO_3 \times H_2O + SiO_2$$

$$K_2SiO_3 \cdot x\,H_2O + CO_2 \rightarrow K_2SiO \times H_2O + CO_2$$

This means the silicates of soda and potash are changed into carbonates with the formation of silica, the silicic acid—a weak acid—being easily displaced from its salts by CO_2. Silicate of soda or potash mixed with a moulding sand is treated *in situ* by the injection of CO_2. The reaction takes place in the mass of the sand and the amorphous silica is produced in the form of a silica gel. This silica gel surrounds the sand grains and brings about a hardening of the core.

Because of their cellular structure, the dry silica gels are extremely porous. The reaction which governs the process is irreversible and thus there can be no danger of the softening or deformation of the treated cores. If after treatment by CO_2 the cores or moulds do soften, because of being saturated with water, fresh treatment with CO_2 cannot bring about their hardening. In this mechanism, when water penetrates too deeply into the mass of the sand which has been treated, the carbonate of soda becomes dissolved and the amorphous silica in the presence of water becomes a colloid—$Si(OH)_x$.

At the time of the introduction of the CO_2, a superabundance of the gas can produce near to the end of the injection tube what has become to be known as "snow-flakes." At the same time, in places remote from the injection zone the concentration of CO_2 can be too weak. It is thus necessary to ensure that injection pipes are not too far away from each other and that the period of treatment should not be unnecessarily prolonged.

Other Phenomena

The formula quoted for the hardening action shows the presence of water of hydration. A significant quantity of wate is thus liberated at casting temperature, and it is, therefore, essential to provide ample and strategically-placed vents. The CO_2 treatment involves an increase in the volume of the mass of the sand. A suitable draft is thus indispensible for withdrawing the pattern or stripping the corebox. For the same reason, the sand should be only lightly rammed.

At the moment of casting, it is necessary that the metal should solidify as quickly as possible on the walls of moulds treated with CO_2 in order to avoid any reaction between the metal and the mould material. Actually, a slight desulphurization of metal in contact with the mould wall can be set up, through reaction with the sodium carbonate. If such a reaction is set up, between the metal and the mould, there is no reason to expect any detectable alteration in the chemical analysis.

The materials comprising the sand mix to be treated are of the following order:—

Dried silica sand	100 parts by weight
Special silicate bond	5 „ „ „
Asphaltic bond	1 part „ „

Instead of silica sand, depending on the weight of the castings and the alloy used (iron or steel), dried chamotte can be used and this should be of a 0.5 to 2-mm. grain size.

Coremaking

In the making of cores, the sand is lightly rammed into the box; in most cases, grids and the like are no longer necessary and, usually, a few irons set in for lifting and core placing suffice. The venting of the centres of cores by coke is not always indispensable; however, for technical reasons, filling with a different sand can be preferred as in other processes of coremaking. After filling, the box is strickled clean and lightly rapped. At intervals of six to nine inches a chrome-steel tube of $\frac{1}{8}$ to $\frac{7}{16}$ in. dia. is pushed to the centre of the core, these holes being for the introduction of the CO_2 during treatment of the core.

* Extract made by *Le Fonderie Belge* of an article which Dr. Schumacher wrote for *Die Giesserei*.

Making Cores and Moulds by CO_2 Hardening

A special CO_2 injection nozzle having a dozen or more holes in its extremity is placed successively down each hole and the CO_2 gas is passed in at from two to four atmospheres pressure. It is necessary particularly to ensure that the treatment begins at the bottom of the box and that the tube is slowly withdrawn until the upper surface of the box is reached. According to the size of the core, the total time of treatment will last from a few seconds to several minutes. After treatment, the core can be stripped from the box and used straightaway. A core which sticks to the box is a sign of too short a treatment. The size of the cores and the metal to be cast will determine whether or not it is worthwhile to coat the core surface either using a sooty flame or a special air-drying coating, both systems allowing of immediate casting.

Properties of the Treated Sand

With the mix detailed above, a number of test cores have been made by means of the Fischer apparatus, using a test-piece 50 mm. long and utilizing three blows of the rammer. Such test cores have been treated for different lengths of time, the CO_2 being introduced by means of a gas-tight diaphragm attached to the tube. Table I gives the average results of three permeability tests, shear and compression strength value for the test-pieces.

TABLE I.—*Properties of CO_2-treated Test-pieces.*

Treatment time in (sec.)	Permeability No.	Shear strength, g. per sq. cm.	Compression strength, g. per sq. cm.
—	150	40	110
1	170	60	110
2	170	60	120
5	170	70	140
10	170	180	260
15	175	710	2,150
20	182	1,580	3,250

As is shown, the permeability varies but little with the time of treatment. On the other hand, immediately after gassing for 15 sec., excellent shear and compression values are shown. The tests demonstrate that for a core 15-mm. dia., a 15-sec. treatment suffices to obtain properties suitable for coring-up and casting a mould. For example, the treatment time for a core weighing 22 cwt. was 120 sec. altogether; another core weighing 3 tons 10 cwts. was treated in 15 mins. This time included that necessary for effective gassing only and not that required for the piercing and stopping up of the injection holes.

Making Moulds by CO_2 Hardening

The CO_2 process can likewise be successfully used for the making of moulds to receive either iron or steel. The composition of the sand is the same as for coremaking. A layer about 2½ to 4 in. thick of special sand is first rammed on the pattern. As the mould should be CO_2-hardened before stripping, it is necessary to provide patterns for the runners and risers and ingates integral with the casting pattern. These components will obviously be encased by a layer of special hardening sand. Then the box is rammed up in the usual way with backing sand.

Before stripping and after having cleaned up the exposed surface of the mould, the same method of gassing as for coremaking is applied—that is, the piercing of holes through to the pattern about 6- to 9-in. apart and of ¼- to ⅜-in. dia. For the injection of the CO_2, it is essential to see that the injection tube reaches the pattern. The holes are subsequntly closed using the special sand, which is straightaway lightly treated with CO_2.

After turning over the bottom box, the moulder places the top box in position and carries on in the same way as for the drag. The pattern is stripped from the mould and the patterns for the runners and risers withdrawn. Any protrusions are lightly broken off, and after blacking, using a sooty flame, the mould is ready for casting. It is essential always to give the patterns generous taper. The easiest castings to make by the process are cylindrical ones moulded on the flat.

Economy of the Process

It is interesting to compare the cost of the process with the conventional system of oil-sand coremaking. For the making of 100 kg. (220 lb.) of core sand, the following ingredients are necessary:—

(*a*) *Oil Sand*

2.5 kg. of oil at 197 D.M per 100 kilo .. .. .. =D.M 4.91

(*b*) *CO_2 Process*

5 kg. of special silicate bond at 60 D.M per 100 kg. .. =D.M 3.00

1 kg. of asphaltic bond at 28.5 D.M per 100 kg. .. .. =D.M 0.29

1.5 kg. of CO_2 at 47 D.M. per 100 kg. .. .. .. =D.M 0.71

Total D.M 4.00

The capital depreciation of the necessary plant is practically negligible, the accessories and apparatus being extremely simple, few in number and cheap. In the oil-sand process, there has to be added the cost of drying. If it be assumed that the cost of drying 100 kg. of oil sand is of the order of 0.14 D.M, then the comparable costs are:—

5.05 D.M for oil sand, and
4.00 D.M for CO_2 sand.

In this comparison of price, no account has been taken of the potential economies to be realized in handling costs, which adversely influence the cost of oil sand. Generally speaking, the economy obtained through the use of CO_2 process favours it to the extent of 20 per cent.

Technical Advantages

To the credit of the economic gains there should also be taken into consideration a series of technical advantages. For example, for the quantity production of cores using coreblowing machines, where the cores produced may be somewhat complicated, resort is had to carriers or sand beds. Cores made by blowing using the CO_2 process, being hardened in their corebox, can eliminate these adjuncts and ancillary operations. It is also possible to introduce the CO_2 at the same time as the compressed air, in such

a manner that the core is hardened during the blowing period. This process under mass production conditions, renders unnecessary any intermediate stocking of cores. On casting, oil-sand cores give off gases which are sometimes somewhat disagreeable; the CO_2-treated cores only produce very little gas, as the quantity of combustible bond is only 1 per cent. This, too, is of the type of fume which rapidly disappears or dissolves in the water-vapour, the latter being formed by the water of hydration of the silicate bond.

If it be assumed that a litre of water at 100 deg. C. gives initially 1,675 litres of steam, it will be realized the CO_2 process demands good venting. The possibility of rapidly drying the cores introduces a considerable time economy. With oil-sand it is sometimes necessary to have 24-hours drying time, yet by the CO_2 process the same core may require but hours at the most and such extra drying time is only necessary for the largest cores.

It may be thought that the sand mix prepared for the CO_2 process would self-harden under the influence of atmospheric CO_2. To prevent this it is merely necessary to cover the prepared sand with damp sacking—a precaution adequate for at least 24 hours.

Accuracy

One of the main advantages of the process is the provision of dimensionally-accurate and stable cores. Oil-sand cores which necessitate drying are removed from their boxes immediately after ramming, that is, at a time when the core is highly susceptible to deformation. It is therefore difficult by the ordinary process to obtain sharp angles and perpendicular planes. Moreover, the oil-sand core is baked in a stove where changes of dimensions are a possibility. The hardening of cores by CO_2 in the core-boxes rules out these risks.

When the strength of cores is taken into consideration, as is shown in Table I, difficulties in de-coring can be envisaged. However, when the hardening is properly computed and above all if a suitable quantity of the asphaltic bond is added, these difficulties are minimized. The time for de-coring and fettling are much the same when using the CO_2 process as with orthodox practice. Because of the high strength of the CO_2 cores, the appearance of cracks or hot-tears in the casting would be expected, but because of the combustion of the asphaltic bond during casting and cooling (shrinking) of the metal, the core is easily removable. Careful compounding of the sand mix cuts out the fear of cracks, but obviously the CO_2 process does not eliminate the classic hot-tears or cracks in steel castings.

Finally, and particularly in winter, it is wise to preheat the CO_2 leaving the gas cylinder, because of the possibility of its solidification as "dry ice." To this end, near the pressure gauge of the gas supply an electric heating system is added. The cylinders are stored in suitable locations, the temperature of which, however, should not exceed 100 deg. F. It is also essential that the CO_2 be free from water. The numerous advantages of combining the CO_2-process and existing methods of mould production open up fresh fields in the spheres of mass-production or jobbing foundrywork in steel, iron or non-ferrous practice. It is, however, as well to note that the new system should not be considered as the sole method of economic or interesting production.

Lifting Restrictions on Dollar Imports

The prospect of the removal of restrictions on dollar imports by the Government, on the very first day that our balance of payments permitted it, was outlined by Mr. D. Heathcoat Amory recently when he addressed the American Chamber of Commerce in London. The former Minister of State, Board of Trade, was speaking shortly before his appointment as Minister of Agriculture and Fisheries. He pointed out that already over the past two years many import controls had been lifted and about half of last year's imports from North America were free from licensing restrictions.

Our economic policy, Mr. Amory went on, was designed towards a freer system of multilaterial trade and payments covering the widest possible area of the world. But the speed with which we moved to such a system must depend upon action taken within the dollar area as well. It would be quite wrong to suppose that U.S. trade policy generally and her policy towards imports in particular were only matters of academic interest. Artificial barriers to imports, he declared, were terrible handicaps, and the damaging effect of uncertainty on export effort must not be underrated.

British businessmen were not afraid of competition, the Minister continued, but Britain did not like competition between governments in export subsidies which could only lead to a mutually destructive race.

Record Employment in 1953

The annual report of the Ministry of Labour and National Service reveals that the number of workers in civilian employment rose during 1953 by 238,000 and that in general the demands for labour were rather greater than in the previous year. Those in civil employment represented nearly 95 per cent. of the total working population, which increased by more than 151,000 to 23,474,000 at the end of the year. The peak was reached in November, when the total was 23,575,000, the highest ever recorded in peace time.

The labour position in the coal-mining industry was broadly satisfactory in 1953, the report states. Manpower in the manufacturing industries increased by 2.5 per cent., while in the metals, engineering, and vehicles groups the rise was 1.5 per cent. There was a rise of 4 per cent. in "vehicles" through increased employment in aircraft manufacture and repair. In metal manufacturing a small rise in iron and steel smelting was more than offset by decreases in tinplate and ironfounding.

Industrial stoppages lost 2,169,000 working days, although it is stated that but for the engineering strike last December the number of days lost would have been the lowest since 1941. Weekly wage rates rose by about 3 per cent. during the year, against 6 per cent. in 1952 and 11 per cent. in 1951. Retail prices rose by 1 per cent., compared with six in 1952 and twelve in 1951.

New Equipment

Semi-automatic "Ejecta" Plate Magnet

Rapid Magnetic Machines, Limited, Lombard Street, Birmingham, 12, have issued details of a new type of permanent plate separator of advanced design and possessing exceptionally strong pulling power. This enables it to extract tramp iron and ferrous particles from a wide variety of powdered, granular and fibrous materials, thereby ensuring a clean product whi'st also protecting the processing equipment from damage or breakdown.

The specially-designed permanent magnets incorporated in these plates do not require electric current to energize, consequently there are no running costs, and they are extremely simple to fit. The cleaning of collected tramp iron and ferrous particles from permanent magnets has, however, always been problematic, but the new "Ejecta" plate has been specially designed to facilitate the removal of such material. The unit is compact and is quite easy to instal as was its predecessor.

The "Ejecta" plate has the general appearance of the previous "Magnaplate." The face has two auxiliary poles hinged and held magnetically in position, on swinging the plate clear of the chute for cleaning two cams operate against the face plate initially breaking the magnetic circuit, thus permitting the face plate to be easily swung clear of the magnet unit the auxiliary poles no longer under magnetic influence, allow the collected iron to fall. The "Ejecta" plate can be supplied in many widths and the magnet strengths available in two sizes capable of handling up to approximately 4-in. depth of feed.

American Shell-moulding Machine

Shallway Corporation, South Fourth Street, Connellsville, Pa., U.S.A., made the first machine, illustrated in Fig. 1, on July 15. It was the initial production of a new 30 by 30-in. shell-moulding plant and is to be installed in the works of the Wright Aeronautical Corporation. The Shallway firm has two factories, and this larger machine, it is gathered, is being produced at that on the West Coast. Machines of smaller size, 14 by 18 in., 18 by 24 in. and others, are being made at the Connellsville and the Palo Alto factories. The new large machine follows the same design as the smaller models, and has a dump box at each end, with a movable oven running on rails between the two pattern frames. It is claimed that the machine turns out two shells or one completed mould every minute. Mr. John B. Shallenberger, the president of the Shallway Corporation announces that a new shell coremaking machine is shortly to be in production at the West Coast plant. It was shown at the recent Cleveland foundry exhibition for the first time and is reported to be gaining popularity in the United States. An interesting statement is that some engineering shops, appreciating dimensional accuracy in the items they use, are making their own castings by shell moulding where previously they purchased from independent founders. For an investment of $5,000—to include a crucible melting plant, a sand mixer and a shell-moulding machine—they can fulfil their modest needs.

Ultrasonic Cleaning Plant

Ultrasonics, Limited, engineers, of Otley Works, Westgate, Otley, recently demonstrated the first ultrasonic cleaning plant of its kind to be made in Europe. It has been produced, in conjunction with Mullard, Limited, for a large American engineering company for their Scottish plant after permission to import a similar machine from the United States had been refused. The purpose of the plant is to clean foreign particles and grease from small precision engineering parts to a degree unobtainable with the conventional cleaning machinery. After being placed in open-mesh trays the parts pass into the plant and go through two small baths containing kerosene. The ultrasonic energy generated into the liquid of one of these baths penetrates parts of the articles normally inaccessible and dislodges the foreign particles. The process takes only a few minutes and on leaving the second bath the trays are conveyed to the next stage of production. It is estimated that more than a million parts can be cleaned daily and the speed of the plant can be adjusted to match the production rate of previous processes. The fluid itself can be cleaned and re-used.

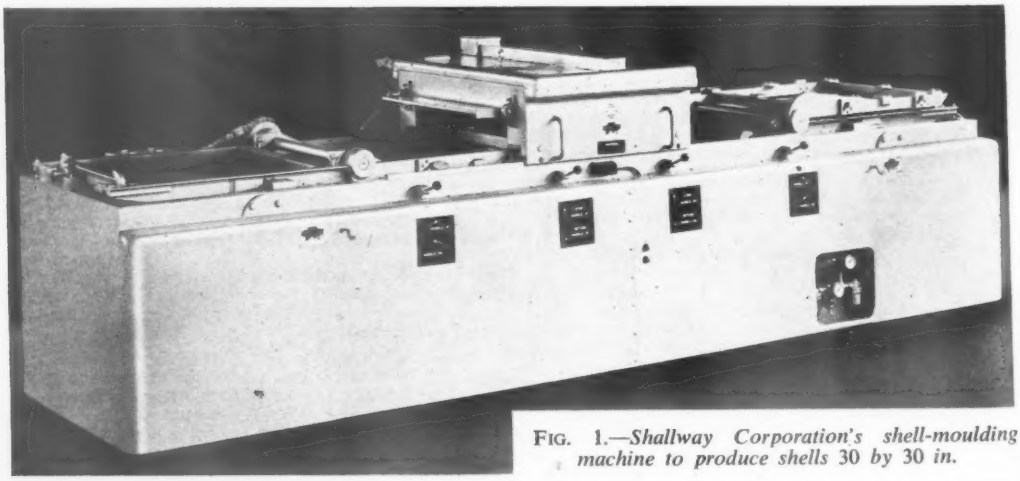


FIG. 1.—*Shallway Corporation's shell-moulding machine to produce shells* 30 *by* 30 *in.*

Possible Uses of Industrial Television*

Some Engineering and General Applications

Industrial television by means of wired (closed-circuit) transmission, it is hoped, will compete in importance as time goes by with entertainment uses. To be able to see where, at present, the human eye is inadequate is a great asset for industrial use. To keep away from dangerous operations, or to make a large audience see happenings which otherwise could only be seen by three or four people are some of the possibilities. Stereoscopic and colour I.T.V. will make future uses more numerous. A few of the ways in a great variety of fields that television has proved itself to be an important and, in some cases, an indispensable aid are as follow:—

Industry.—Control of foundry and rolling mill processes (Fig. 1); observation of hazardous machining operations; inspection of inaccessible places such as gun barrels, insides of tanks and cylinders, castings, borings, factory chimneys and grain elevators; remote reading of dials and gauges in dangerous and difficult positions, and viewing tests involving high temperature, voltage, speeds or other personal dangers.

Research.—All types of telemetering; viewing experiments involving possible explosions, radio activity and other hazards; counting minute objects; and close or lengthy observation of experiments.

Education and Training.—Demonstrations of small or inaccessible objects to large classes; relaying a lecture to several separate rooms simultaneously; visual touring of a factory or business premises by visitors from a reception room; improving personal contacts by the use of television in conjunction with the telephone.

Although at present this equipment is limited to special applications, it may well be that the day is approaching when many organizations will incorporate and build in television systems as an integral part of their operations.

Examples of Practical Uses

The following examples have been selected at random from a far wider range of installations in this country and in U.S.A. based on data and/or illustrations provided by the makers of I.T.V. equipment.

The study of destructive tests on machinery, of dangerous chemical experiments or electrical breakdown tests, is possible when industrial television equipment is employed. The firm of Marconi's Wireless Telegraph Company, Limited, of Chelmsford, provided cameras for demonstrating tests on high-voltage air-blast switchgear at the Nelson Research Laboratories of the English Electric Company, Limited, with outstanding success. The tests were performed on switches designed for voltages up to 400,000 volts, and the cameras were placed in positions where no observer would have been allowed. A number of tests were run to observe whether the very great shock which occurred the moment the fault current was thrown on to the test switch had any effect on the electric conductors in the generating-plant windings. Observers in a room were able to watch on monitor screens the effect on windings and the behaviour of equipment.

Fig. 2 illustrates a demonstration at the National College of Rubber Technology of the new industrial Pye camera, which produces a bright picture and can be operated by untrained people. The makers claim that it operates up to a distance of 1,000 ft., feeding any number of receivers up to 15. It is well known that in technical education of apprentices, and in demonstration of working of machine tools to a great number of people, direct instruction is difficult. Industrial television overcomes this problem enabling up to 40 people to view machining on a monitor screen or in a lecture room away from the actual demonstration.

The American Du Mont equipment works on a Dumitter closed circuit system for a single closed-circuit camera chain and one microphone. A Dumitter T.V. signal distribution system can feed up to 125 sets of receivers. A co-axial cable connects the camera chain video output to the Dumitter video input. A microphone and its amplifier are set up in the lecture room, and one amplifier output is connected to the audio input of the Dumitter.

At the seamless tube mill of the Timken Roller Bearing Company, at Canton, Ohio,

* Extract from an article appearing in *Iron & Coal Trades Review*.

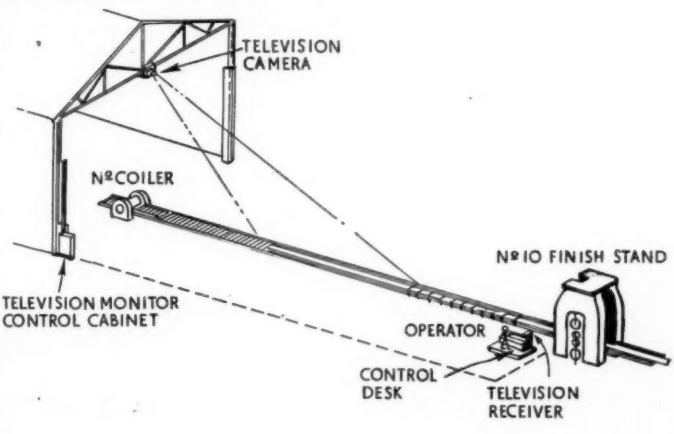
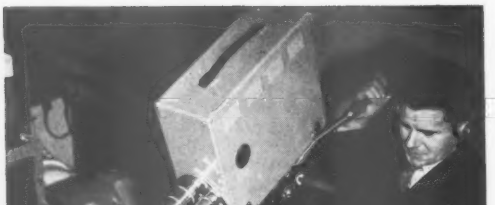


FIG. 1.—*Location of television camera and control cabinet on an 80-in. hot strip mill.*

[Courtesy, United States Steel Corporation, Ind., U.S.A.



(Courtesy, Pye, Limited, Cambridge.

FIG. 2.—*Pye industrial camera in a demonstration at the National College of Rubber Technology.*

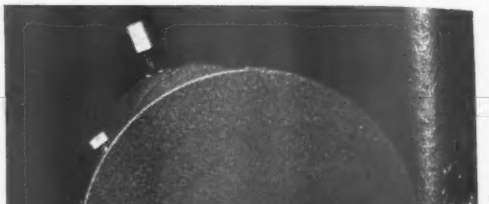


FIG. 3.—*Production manager studies assembly-line operations on a remote monitor screen.*

the tubes are automatically fed into a furnace sidewise and travel through on a conveyor. In order to eliminate a second man at the charging end required to avoid "pile ups" in the furnace, a "Utiliscope" I.T.V. camera looks directly into the furnace. The image is brought to a viewing screen right in front of the dispatcher. By varying conveyor speed, he maintains uniform furnace feed and avoids "bottlenecks."

Fig. 3 illustrates a plant supervisor watching an assembly line on a monitor screen. The camera is placed above the workers, who are not aware of its presence. This method of observation, used in time- and motion-study is preferable to direct readings by a time-study engineer, which might embarrass workers and falsify results. This type of camera produces pictures in natural colours. Colour cameras have been recently developed by several firms in Great Britain, but are not on the market yet for I.T.V.

Of special interest to production managers and engineers is the industrial colour-television equipment of Du Mont Laboratories, of Clifton, N.J., U.S.A., producing brilliant coloured views. With the addition of stereo—or three-dimensional colour I.T.V. equipment, developed by the Remote Control Engineering Division of the Argonne National Laboratory through co-operation with several makers of I.T.V. equipment, nuclear research and operation has been facilitated. Mechanical hands in nuclear reactor plants can be accurately guided even to the picking up and pouring of small flasks and test-tubes behind thick protective barriers. In this country, a Pye industrial T.V. camera is being used at the British Atomic Research Establishment, but no data are available as to the exact application. It can be safely assumed that industrial television equipment will be used in the near future for various purposes in progressive metallurgical and engineering works.

German Steel Output's Post-war Record

In the 28 working days last month, Germany is reported to have produced 1,570,000 tons of crude steel —the highest since before the war. The June output was 1,405,000 tons. The previous post-war highest output was attained in January, 1953, when production totalled 1,483,000 tons.

Mechanization of Quarries Effect on Accident Rates

The number of persons employed at quarries working under the Quarries Act, 1894, during 1952, averaged 62,038, including 8,360 at open-cast coal workings, according to the report for the year of H.M. Inspectors of Mines and Quarries. Comparable figures for 1951 were 62,704 and 8,953 respectively.

South African Foundry Conference

The fourteenth annual conference of the Meehanite Metal Research & Development Association of Southern Africa was held in April in the conference room of Sasbo House.

On the first day of the conference Mr. A. G. L. Lewis presided over the foundry session, following which a symposium of papers entitled "Cupola Operation" was presented by Mr. E. Dibdin (Escher Wyss Austral Iron Works, Limited), Mr. W. Liebenberg (Wright, Boag & Head, Wrightson (Pty.), Limited, Mr. J. A. Walker (Meehanite Metal Company), Mr. I. Duncan (East Rand Engineering Company) and Mr. G. M. Gardner (African Malleable Foundries).

Later, Mr. E. Dibdin read a paper on "Discrepancies in Chemical and Physical Testing" and a tape-recorded discussion was also given of the address of Mr. A. R. Cluett (African Malleable Foundries) on "Testing Errors."

Other papers presented were those on "Shell Moulding" by Mr. J. A. Waller (Meehanite Metal Company), "Possible Alternative to Shell Moulding" by Mr. B. Haigh (Wright, Boag & Head, Wrightson (Pty.), Limited); "Pouring Speeds," by C. Norbury (Escher Wyss Austral Iron Works, Limited), which was followed by a cine film entitled "Flow of Metal."

The first day ended with discussions on papers dealing with "Production Methods for Valve and Miscellaneous Production Castings"; "Meehanite as a Chemical Plant Material"; "Prevention of Graphite Corrosion"; "Modulus of Elasticity of Meehanite"; "Welding of Meehanite"; "Manufacturing of Babbitt-lined Meehanite Bearings and Crossheads" and "Mechanical Handling Equipment for the Foundry."

Second Day

On April 9, the day's activities began with a business meeting of the Meehanite Metal Association, and Mr. V. K. Rice took the chair for the management session. The third report on "Basic Cupola Operation" by the Meehanite Metal Company and its members was given, while various other papers presented were by Mr. J. L. Rohtbart (African Malleable Foundries) on "Economics in Quality Control"; Mr. R. D. Pritchard (African Malleable Foundries) on "Daily Profit-and-loss Statement," concluding with a tape recorded address by Mr. H. A. Godwin (African Malleable Foundries).

Later, an official luncheon took place at Luthje's Langham Hotel—it was presided over by Mr. D. M. Davidson, the guest speaker being Mr. R. V. Sutton, senior liaison officer, National Institute for Personnel Research, and Mr. H. J. G. Goyns, Drury & Company, who is also president of the South African branch of the Institute of British Foundrymen and vice-president of the Institution of Production Engineers (South African branch), proposed a vote of thanks.

"Sirocco Extensions"

Davidson & Company, Limited, Sirocco Works, Bridge, Belfast, have in recent years embarked upon large-scale extensions to their works and at present employ about 1,500 people. A shop now being erected will bring their total working unit up to 30,000 sq. ft. Much attention is being given to research and new laboratories, comprising experimental and testing departments have been provided on a new site. During 70 years of existence, the company has followed a progressive policy.

B.I.S.R.A. Annual Report

In his address as chairman of the British Iron and Steel Research Association, Captain H. Leighton Davies, C.B.E., said in his Annual Report that it was the Council's policy that members should be given an opportunity each year to see at least one of the laboratories of the Association and to discuss the research work in progress with the scientific staff. Such an opportunity occurred in Sheffield when the new laboratories were officially opened in the autumn of last year. This year it was intended to invite members to inspect the Battersea premises where the plant engineering division and the physics and chemistry departments including corrosion, had their laboratories. The "Open Days" were planned for November 18 and 19 at the time of the Iron and Steel Institute autumn meeting. It was hoped that there would be a large number of visitors from the industry, universities and other research laboratories. In future years it was proposed to hold "Open Days" at other laboratories.

Membership

The membership of the Association continued to grow so that now there were 293 ordinary members and 45 associate members. The associate members were closely connected with the industry and included suppliers of raw materials, makers of capital equipment and processors or users of iron and steel. The Council was particularly keen to increase the participation of manufacturers of steel works plant and equipment as there was considerable scope for research which would be of benefit to the British iron and steel industry, as well as to plant makers in meeting foreign competition. The plant engineering division was now well equipped for research on plant design and layout, steel works cranes, reheating and other furnaces, handling equipment, etc.

Of the variety of questions asked of the Association in a year, a large proportion related to problems of corrosion. The Council had arranged to devote more of the resources of the corrosion laboratory to the answering of such questions through a corrosion advice service. Where enquiries were of a nature which could not be answered without protracted investigations a fee would be charged.

It was of interest to recall that there were now nearly 50 patents pending or granted which were vested in the name of the Association, of which more than half were in process of exploitation in one form or another. A member of the staff had been specially appointed to take charge of commercial development and to exploit where appropriate these patents in the steel and other industries and to negotiate agreements.

The Council had co-opted the services of Sir Lincoln Evans, who was deputy chairman of the Iron and Steel Board, Mr. E. W. Colbeck, and Mr. R. A. Hacking, who were chairmen of the metallurgy and ironmaking divisions of the Association.

India's Coal Reserves

In an investigation of the desirability of setting up plant in India to extract petrol from coal, it is pointed out that India's known coal reserves to a depth of 2,000 ft. amount to 60,000,000,000 tons. The reserves of coal of all grades workable by present methods are 20,000,000,000 tons, of which some 5,000,000,000 tons is first-grade coal, some 1,750,000,000 tons being suitable for metallurgical use. Present-day internal consumption of all grades of coal is 35,000,000 tons and 3,000,000 tons for the manufacture of metallurgical coke.

British Blast Furnaces in the June Quarter, 1954

(These tables are published through the courtesy of the British Iron and Steel Federation.)

Derbyshire, Leicestershire, Notts, Northants, and Essex.

Name of firm.	In blast at end of the second quarter, 1954. Hematite.	Basic.	Foundry and forge.	Ferro-alloys.	Total.	Weekly average in blast.	Total existing at end of quarter.
Clay Cross	—	—	1	—	1	1	2
Ford Motor	—	—	1	—	1	1	1
Holwell Iron	—	—	3	—	3	3	4
Kettering Iron & Coal	—	2	—	—	2	2	2
New Cransley Iron & Steel	—	—	1	—	1	1	2
Renishaw Iron	—	—	1	—	1	1.8	2
Sheepbridge	—	1	1	—	2	2	2
Stanton Ironworks: Stanton-by-Dale	—	—	4	—	4	4	5
Staveley Iron & Chemical	—	—	4	—	4	4	4
Stewarts and Lloyds: Corby	—	4	—	—	4	4	4
Wellingboro' Iron	—	2	—	—	2	2	3
TOTAL	—	9	16	—	25	25.8	31

Lancashire (excl. N.-W. Coast), Denbighshire, Flintshire, and Cheshire.

Brymbo Steel	—	1	—	—	1	1	1
Darwen & Mostyn	—	—	—	1	1	1	1
Lancashire Steel Corp'n.	—	2	—	1	3	3	3
Summers, J.	—	1	—	—	1	1	1
TOTAL	—	4	—	2	6	6	6

North-West Coast.

Barrow Ironworks	2	—	—	—	2	2	4
Charcoal Iron	—	—	—	—	—	0.5	1
Millom & Askam	2	—	—	—	2	2	3
United Steel: Workington	2	—	—	1	3	3	3
TOTAL	6	—	—	1	7	7.5	11

Lincolnshire.

Appleby-Frodingham	—	5	—	—	5	5.3	7
Lysaght's Scunthorpe Works	—	3	—	—	3	3	4
Thomas, R., & Baldwins: Redbourn	—	2	—	—	2	2	3
TOTAL	—	10	—	—	10	10.3	14

North-East Coast.

Consett Iron	—	3	—	—	3	3	3
Dorman, Long: Acklam	—	3	—	—	3	3	4
Redcar	—	2	—	—	2	1.7	2
Cleveland	—	2	—	—	2	2	4
Bessemer	—	3	—	—	3	3	3
South Bank	—	—	—	2	2	2	3
Gjers, Mills & Co.	2	—	—	—	2	2.3	5
Normanby Ironworks	2	—	—	—	2	2	3
Skinningrove Iron	—	2	—	—	2	2	3
South Durham Steel & Iron: West Hartlepool	—	2	—	—	2	2	2
Cargo Fleet	—	2	—	—	2	2	2
TOTAL	4	19	—	2	25	25	34

Scotland.

Bairds & Scottish Steel: Gartsherrie	1	1	1	—	3	3.1	5
Carron	—	—	1	—	1	1	4
Colvilles: Clyde Works	—	3	—	—	3	3	3
Dixon's	—	2	—	—	2	2	6
TOTAL	1	6	2	—	9	9.1	18

South Wales and Monmouthshire.

Briton Ferry Works	1	—	—	—	1	1	1
Guest Keen Iron & Steel: Cardiff	1	2	—	—	3	3	4
Thomas, R., & Baldwins: Ebbw Vale	—	2	—	—	2	2	3
Steel Company of Wales: Margam	—	3	—	—	3	3	3
TOTAL	2	7	—	—	9	9	11

Shortage of Science Teachers

While the increasing need for science graduates in industry is widely appreciated and much is being done to attract young scientists from the universities, practical encouragement is being hampered greatly by the lack of science masters at the schools where the budding scientist must be nurtured. Last January, the Federation of British Industries set up a committee under the chairmanship of Sir Percy Dunsheath to enquire into the problem. The committee, in its findings, estimates that in the period 1950-60 there is an annual deficit of 230 men and women science teachers, which may result at the end of the 10 years in the shortage of over 2,000.

Making its recommendations, the committee feels that a main cause of the shortage is the discrepancy between the rates of pay of senior science masters and older scientists in industry or in the technical schools. On an average, says the committee, the science teacher may find the difference as much as £500 p.a. at 40 and over £600 p.a. at 50. To offset this it recommends a new income scale based on four grades of assistant masters, providing a finishing salary of £900, £1,100, £1,300, and £1,500 for the respective groups. According to the class of degree obtained, starting salaries would range from £580 to £620.

Among other measures recommended by the committee is that intending graduate science teachers should undertake full-time National Service for basic training only, provided that they then serve with the Territorial Army or with a

school cadet - corps. Students who wish to change from arts to science on entering a university, it is suggested, should be eligible for four-year grants and, further, that the universities should provide pre-entry or preliminary science courses for students without science qualifications.

Duke Visits "Alcan" Project

The varied interests of the Duke of Edinburgh are evident from the itinerary for his present visit to Canada. Although he spent some time at the Empire Games at Vancouver, the Duke's attentions are also directed towards industry. Thus, it is not surprising that last week, the sixth day of his tour, he flew by helicopter to view "Alcan," the mammoth aluminium-producing project of the Aluminium Company of Canada at Kitimat, in a remote part of north-west British Columbia. Previously, at Kemano, the Duke had visited the power-house, built inside a mountain, which is to provide the electrical power needed for the project. Much of the heavy equipment he inspected there has been provided by British manufacturers.

Last Tuesday the first aluminium ingot was poured at the new smelter at Kitimat marking the completion of the first phase of the £200,000,000 scheme, three years and three months after construction began. The first phase aims at generating enough hydro-electric power to enable the smelter to produce 90,000 tons of aluminium a year. It necessitated the building of the Kenney Dam, one of the largest rock-filled dams in the world. From the lake created by the dam, water is conveyed through a tunnel 10 miles long and 25 ft. wide to the Kemano powerhouse, where three vertical-type turbines each produce 150,000 h.p. The power-house has, however, been designed to accommodate eight turbines, with a total capacity of 1,120,000 h.p. From Kemano the power is carried by overhead transmission lines to the Kitimat smelter, 50 miles away.

THE IRONSTONE MINE at South Skelton (Yorks), owned by Dorman, Long & Company, Limited, closed down on August 7 owing to the deterioration of the quality of the Cleveland ironstone. The mine has been in operation since 1870. A small number of key men can be transferred to other mines, and it is expected that most of some 200 displaced workers will find employment in the company's works and development sites within the area.

British Blast Furnaces in the June Quarter, 1954—*continued*

Staffordshire, Shropshire, Worcestershire, and Warwickshire.

Name of firm.	In blast at end of the second quarter, 1954.					Weekly average in blast.	Total existing at end of quarter.
	Hematite.	Basic.	Foundry and forge.	Ferro-alloys.	Total.		
Goldendale Iron	—	—	1	—	1	1	2
Lilleshall	—	—	1	—	1	1	2
Round Oak Steel Works	—	—	1	—	1	1	2
Shelton Iron, Steel & Coal	—	3	—	—	3	2.5	3
Stewarts and Lloyds: Bilston	—	3	—	—	3	3	3
TOTAL	—	6	3	—	9	8.5	12
Sheffield.							
Park Gate Iron & Steel	—	2	—	—	2	2	2
GRAND TOTAL	13	63	21	5	102	103.2	139

Weekly Average Number of Furnaces in Blast during the June Quarter, 1954, and the Previous Four Quarters

District.	1953.			1954.	
	June.	Sept.	Dec.	March.	June.
Derby, Leics., Notts., Northants, and Essex	26.8	26.5	26.9	26.2	25.8
Lancs. (excl. N.-W. Coast), Denbigh, Flint, and Ches.	6	6	5.9	6	6
Lincolnshire	13	12.6	12	11.2	10.3
North-East Coast	24	24	24.7	25	25
Scotland	8.5	9	9	9	9.1
Staffs., Shrops., Worcs., and Warwicks.	7.8	8.9	9	9	8.5
S. Wales and Monmouth	8.4	7.6	9	8.9	9
Sheffield	2	2	2	2	2
North-West Coast	6.6	8	8	8	7.5
TOTAL	103.1	104.6	106.5	105.3	103.2

The following companies have furnaces in course of construction or rebuilding:—Darwen & Mostyn Iron; John Summers; Appleby-Frodingham Steel Co.; Stewarts and Lloyds (Bilston); Dorman, Long & Co.; Lancashire Steel Corporation; South Durham Steel & Iron (West Hartlepool); Steel Co. of Wales.

Increases of Capital

STERLING METALS, LIMITED, Foleshill, Coventry, increased by £50,000, in £1 shares, beyond the registered capital of £350,000.

FOUNDRY MECHANISATIONS (BAILLOT), LIMITED, London, S.W.7, increased by £20,000, in £1 shares, beyond the registered capital of £15,000.

MINERALS SEPARATION, LIMITED, London, E.C.4, increased by £500,000, in 5s. ordinary shares, beyond the registered capital of £500,000.

LANGLEY ALLOYS, LIMITED, Langley (Bucks), increased by £75,000, in £1 ordinary shares, beyond the registered capital of £175,000.

JOHN HILL & SONS (IRON FOUNDERS), LIMITED, Wolverhampton, increased by £20,000, in £1 ordinary shares, beyond the registered capital of £5,000.

THOS. W. WARD, LIMITED, increased by £1,800,000, in 1,100,000 ordinary and 700,000 unclassified shares of £1 each, beyond the registered capital of £2,200,000.

HAMWORTHY ENGINEERING COMPANY, LIMITED, Hamworthy, Poole (Dorset), increased by £10,000, in 10s. ordinary shares, beyond the registered capital of £100,000.

WILLIAM BOULTON, LIMITED, ironfounders, etc., of Burslem, Stoke-on-Trent, increased by £30,000, in £1 ordinary shares, beyond the registered capital of £30,000.

T. H. & J. DANIELS, LIMITED, general engineers, ironfounders, etc., of Stroud (Glos), increased by £100,000, in £1 ordinary shares, beyond the registered capital of £87,500.

PROJECTILE & ENGINEERING COMPANY, LIMITED, London, S.W.8, increased by £150,000, in £1 6 per cent. cumulative preference shares, beyond the registered capital of £400,000.

C. & W. WALKER, LIMITED, gasworks engineers, ironfounders, etc., of Donnington (Salop), increased by £150,000, in 5s. ordinary shares, beyond the registered capital of £150,000.

CLARKE, CHAPMAN & COMPANY, LIMITED, boilermakers, marine and electrical engineers, etc., of Gateshead, increased by £770,000, in £1 ordinary shares, beyond the registered capital of £550,000.

BARBER, WILSONS & COMPANY, LIMITED, brassfounders and engineers, of London, N.22, increased by £30 000, in 10 000 6 per cent. cumulative redeemable preference shares and 20,000 ordinary shares of £1 each, beyond the registered capital of £10,000.

Publications Received

Code of Procedure to Facilitate the Co-ordination of Inspection for Copper-base Alloy Castings, Ordered by the Ministry of Supply. Issued jointly by the Association of Bronze and Brass Founders and the Ministry of Supply Inspectorates and published by the former from 69, Harborne Road, Birmingham 15; price 5s. (members 3s. 6d.).

The broad object of this Report is set out in the title, but it is better elaborated in the first clause: "Further, it is the purpose of this code to detail an inspection procedure for Government contracts and sub-contracts which will give the maximum possible information on the properties of copper-base alloy castings, without unreasonable expenditure of materials, time and labour, and to co-ordinate as far as possible inspection procedures in order to facilitate inspection and ultimately to assist both designer and founder in maintaining or improving the quality of castings."

First of all, the general business clauses are set out, such as the supply of castings not covered by British Standard Specifications; acceptance conditions, arbitration, and so forth. Moreover, the existing classifications are related to those used in the code.

It is clearly shown that tensile tests on separately-cast bars only show the quality of the metal used for making the castings. Instructions are given for the preparation of such bars. The conditions governing the ascertainment of chemical composition conclude Part I.

Part II is devoted to "Additional Tests where Required," and initially covers proof stress and hardness testing. The latter is very extensively dealt with and no fewer than twelve tables are included. Clauses are devoted to pressure testing; crack detection and radiological examination. Part III, which is not applicable to aircraft castings, caters for foundries which are not approved to carry out their own inspection. This is a very useful statement and not at all frightening. Part IV sets out the procedure to enable a foundry to become approved as a firm having suitable inspection arrangements. This, too, is distinctly helpful, as before the publication of this Code, it was difficult to acquire the necessary information. Part IV deals with the operation of an approved inspection department, whilst Part V is entitled "Documentation," a word the reviewer had always regarded as French, but which he is pleased to find in some of the standard dictionaries. This section sets out the necessary paper work to be undertaken for the recording of the whole process of inspection. Part VI covers the stamping of the castings and release notes. The last section details the inspection conditions for machined castings where the foundries undertake this additional activity. Finally, there is a directory of the district offices of Inspectorates. In this part, there is probably a misprint of "northern" for western in the case of a Bristol address.

It is an excellent and really useful document and copper-base foundry owners should indeed be grateful for the important work that has been done on their behalf. At the price charged, such a compendium of information is really very cheap.

Duty-Free Entry of Machinery into the United Kingdom and Report of a Committee appointed by the President of the Board of Trade. Published by Her Majesty's Stationery Office, York House, Kingsway, London, W.C.2. Price 1s. 3d. net.

This Report is of great importance to industry. The committee had before it the evidence of over a hundred firms and trade associations—including the Foundry Trades Equipment and Supplies Association. The main recommendation is probably No. 4 "The statutory provision for the remission of import duty on machinery should specify as the basic criterion for duty-free admission the non-procurability of similar machines in the United Kingdom." It is interesting to learn that the imports of duty-free "furnace and foundry plant" varied from £6,100 in 1949 to £170,000 in 1951.

In March, 1952, the system of issuing licences for free imports ended. Just before the system finished the average weekly applications were of the order of 290. In general this is a very interesting and important Report.

"Seraphim." Published by the Appleby-Frodingham Steel Company, Scunthorpe, Lincolnshire.

"Seraphim" is a word coined from the location of the extensions to the ironworks and the initials of the parties most interested. The booklet, beautifully presented, details the initial difficulties associated with the normal supplies of iron ore and coke, the researches and methods used to overcome them and finally the construction, spread over several years, of an iron and steel works, which is modern in every concept and of which the firm are justly proud. The brochure is splendidly illustrated and in its way is a worth-while contribution to engineering and metallurgical literature. The reviewer congratulates those responsible for producing such an outstanding description of a complicated, integrated manufacturing project.

Ninth Annual Report, issued by the Council of Industrial Design, Tillary House, Petty France, London, S.W.1; price 1s. 6d.

The main interest of this report is the inclusion of a 12-page inset of pictures on art paper of recent designs. Amongst these are a number germane to foundrymen. There are, for instance, an overnight-burning fire designed for Wilmer Lea Foundries Ltd.; a rotary fused isolation cover for Midland Electric Manufacturing Company Limited; a name-plate made by Butler Jones (Nameplates) Limited and a gas convector for Vulcan Stove Company Limited.

House Organs

Nassau. 1954 American Foundrymen's Society Convention Issue. Published by the Nassau Smelting & Refining Company, Inc., Tottenville Works, Station Island 7, New York City, U.S.A.

This issue contains an article reprinted from the JOURNAL on "Production of Castings in Aluminium Bronze," by L. Hargreaves. The balance is made up of a series of quite interesting paragraphs, news of the personnel of the works and their holiday plans, which in many cases includes house painting.

"600." Vol. 28, No. 127. Published by George Cohen Sons & Company Limited, Cunard Works, Chase Road, London, N.W.10.

This issue well maintains the high standard responsible for its huge circulation. There is an article on German wines by Mr. Frank Rowe. It is a field which but few moderns have real knowledge, their experience generally being limited to French wines. Mr. Rowe's recent award of the E. J. Fox Medal of the Institute of British Foundrymen is duly recorded. The first article covers the field of second-hand machinery, and places the situation in its proper perspective.

Personal

Mr. ALAN IVOR BAKER, chairman and managing director of Baker Perkins, Limited, engineers, of Peterborough, has been appointed a Justice of the Peace for the Soke of Peterborough.

RUSTON & HORNSBY, LIMITED, announce the appointment to the Board of directors of MR. G. W. BONE. Mr. Bone is the only son of the late Mr. Victor W. Bone, a former chairman of the company.

Mr. A. E. BELL, principal of the engineering department at the County Technical College, Wednesbury (Staffs), for the past five years, is leaving to take up a similar appointment at Bolton Technical College.

MR. JACK KEISER, assistant education officer at Samuel Fox & Company Limited, steelworks, Stocksbridge, near Sheffield, has been appointed education officer to the Folland Aircraft Limited, near Southampton.

The Master Cutler, Mr. R. L. WALSH, has been elected to the Council of the British Iron and Steel Research Association. He has been an active member of the Cutlery Research Council, and his election to the B.I.S.R.A. Council stems from this.

MR. J. CHAMBERLAIN, chief engineer, and MR. H. A. BLACKWELL, manager of the evaporator division, have been appointed directors of Aiton and Company, Limited, pipe engineers, Stores Road, Derby. Mr. Chamberlain has been associated with the company since 1914, and Mr. Blackwell since 1921.

Mr. J. MCCALLUM, of Mavor & Coulson, Limited, Glasgow, has been appointed chairman of the Glasgow and district branch of the Purchasing Officers' Association, Mr. H. J. MILNE, Hoover (Electric Motors), Limited, vice-chairman, and Mr. W. J. CARTER, Alley & MacLellan, Limited, Glasgow, honorary secretary.

Mr. W. ATKINSON, who has been with John Thorneycroft & Company, Limited, engineers and shipbuilders, etc., of Westminster, London, S.W.1, for 26 years, has been appointed assistant secretary. He succeeds Mr. N. M. MILLARD, who has resigned because of ill-health after serving the company for 35 years. Mr. Millard has also resigned from the board of Hampton Launch Works, Limited, and as secretary of Basingstoke Buildings, Limited.

MR. ALBERT JACKSON, whose appointment to the Board of the Appleby-Frodingham Steel Company Branch of the United Steel Companies, Limited, is announced, joined the company in 1920. For the first 16 years of his association with the company, Mr. Jackson was employed as a chemist: in 1936 he was appointed melting shops manager and in 1948 works manager (steel). His appointment as general works manager was announced last year. Mr. Jackson has been a member of the Council of the Lincolnshire Iron & Steel Institute since 1933, and is chairman of the Advisory Committee of the City and Guilds iron and steel operatives' course.

Mr. FRANCIS T. HEARLE, chairman of the de Havilland Aircraft Company, Limited, since 1950, has relinquished that post on medical advice, but remains a director of the company. One of the founders of the company in 1920, Mr. Hearle became a director in 1922 and managing director in 1938. He is succeeded as chairman by Mr. W. E. NIXON, deputy chairman and managing director, who retains the latter post. Mr. Nixon was secretary of the company from its inception, becoming a director in 1931. He is chairman of de Havilland Propellers, Limited, and a director of the de Havilland Engine Company, Limited. Mr. F. E. N. St. BARBE, deputy managing director, is now also vice-chairman.

Obituary

Mr. ARTHUR YOUNG, principal of Arthur Young & Company, iron and steel merchants, of Sheffield, has died at the age of 77.

Mr. HARRY WATT, formerly managing director of Watson, Laidlaw & Company, Limited, iron and non-ferrous founders and engineers, of Glasgow, died on August 3.

MR. BERTRAM WATSON, who had worked at Park Foundry, Belper, Derbyshire, for 55 years, and held the position of foreman for more than 30 years, died on August 5.

Mr. JOHN FIELD TONGUE, who joined Belliss & Morcom, Limited, engineers, of Birmingham, 50 years ago as an erecting engineer, has died at the age of 78. He was the company's leading installation engineer on overseas contracts and was responsible for work in Europe, Asia, Africa, and South America.

Mr. WILLIAM RAWLINGS, who joined William Doxford & Sons, Limited, marine engineers and shipbuilders, of Sunderland, as an office boy in 1891, has died at the age of 77. In 1928, he became secretary of the engineering department, and seven years later he was appointed secretary of the company. He retired in 1945.

Mr. STEPHEN EVANS ALLEY, who has died at Hunstanton (Norfolk), succeeded his father as head of Alley & MacLellan, Limited, the Glasgow engineers and ironfounders. Mr. Alley designed many pumps and other engineering products. He also developed the "Sentinel" steam wagon and began manufacturing it in Shrewsbury after he had sold his interest in the Glasgow firm. On retiring he went to live in Huntingdon, but returned to Shrewsbury before the last war in order to supervise the reconstruction of the firm. Later the business was sold to Metal Industries, Limited, and Mr. Alley retired again, this time to the Norfolk coast. He was 82.

Resumption of the Duty-free Licensing of Machinery

In a written answer to a Parliamentary question recently, the President of the Board of Trade announced that in accordance with the recommendations of the Report* of the Committee on the Duty-free Entry of Machinery, the Government had decided to resume, as from August 4, 1954, the duty-free licensing of machinery under Section 10 of the Finance Act. 1932. This decision applied to all machinery which had not been delivered from Customs charge before August 4 provided that the applicant had, before delivery of the machinery from Customs charge, (*a*) ensured that an application for a duty-free licence is received by the Board of Trade; (*b*) informed Customs about the application.

Applications, which may be lodged forthwith, should be addressed to I.M.1 Division, Board of Trade, Horse Guards Avenue, London, S.W.1, from whom application forms and full instructions can now be obtained. Board of Trade,

*The Report has been reviewed on page 188 of this issue.

Proposed Foundry Extensions

BRENT FOUNDRY, Studley Road, Hanwell, London, W.7, Maple Foundry Company, Great Bridge Street, West Bromwich and Kent Engineering and Foundry, Limited at Phoenix Works, Tovil, near Maidstone, Kent, are seeking permission to extend their foundry premises.

News in Brief

CROMPTON PARKINSON, LIMITED, announce that Mr. R. R. Kenderdine has been appointed an executive director.

IN AN EXHIBITION of physics and chemistry, organized by Queen Mary's School, Walsall (Staffs), is a miniature gasworks which burns its own coal and produces gas and by-products.

THE WEST BENGAL GOVERNMENT has submitted to the Planning Commission of the Union Government a scheme for the establishment of a coke-oven plant at Durgapur, in the Burdwan district.

A DEPARTMENT of Evered & Company, Limited, Smethwick, for the manufacture of brass electric, gas, and water fittings, is being rehoused in a new, modern building during the annual holiday.

BELGIAN PRODUCTION of pig-iron in June was 390,977 metric tons. The output of crude steel was 420,162 tons, of which 369,800 tons was basic-Bessemer, 41,158 tons open-hearth, and 9,204 tons electric steel.

LATEST FOUNDRY STATISTICS: According to the Ministry of Supply, the output of aluminium castings during May was:— as sand-cast 1,799 tons; as gravity-die-cast 3,562 tons, and as pressure-die-cast 1,205 tons.

WOLVERHAMPTON AND STAFFORDSHIRE TECHNICAL COLLEGE is to introduce a new "sandwich" course for the advanced diploma in industrial engineering, covering a period of three years and beginning in October.

DURING April and May, 23 industrial development certificates involving a total factory space of over 614,000 sq. ft. were issued in the Newcastle-upon-Tyne area. These developments are expected to provide work for 1,769 people.

THE ABILITY of the firm's aircraft wiring cables to meet the extremely wide range of conditions experienced in modern aircraft is the theme of the British Insulated Callender's Cables, Limited, stand (number 159) at the S.B.A.C. display, Farnborough.

THE fourth international Packaging Exhibition is to be held at Olympia, London, from January 18 to 28, 1955. The organizers, Provincial Exhibitions, Limited, in collaboration with the Institute of Packaging, state that it will be the largest exhibition of packaging ever organized in this country.

SUBJECT TO ADJUSTMENT in respect of service and spares equipment that may be retained, the International Harvester Company of Great Britain, Limited, has conditionally agreed to pay Jowett Cars, Limited, £685,000 for the land, buildings, plant, etc., of its Springfield Works at Idle, Bradford.

THE INDIAN GOVERNMENT has sanctioned a special advance of Rs.100,000,000 to the Tata Iron & Steel Company, Limited, Bombay. The money will be used partly to carry out a Rs.330,000,000 modernization programme scheduled to raise production of finished steel in the company's works from 750,000 tons to 931,000 tons by the end of 1957.

GENERAL REFRACTORIES, LIMITED, have now opened an office at The White House, 111, New Street, Birmingham, 2. This address will be the headquarters of Mr. G. Griffiths who will be assisted by Mr. William M. Aikman. In the Middlesbrough area, Mr. Geoffrey G. Abraham has been appointed to represent the firm, in succession to the late Mr. C. Ramsden.

THE BOARD of the Staveley Coal & Iron Company, Limited, Chesterfield, has completed arrangements for the acquisition of the whole of the issued share capital of W. H. Smith & Company (Electrical Engineers), Limited, of Manchester. The latter company will continue under the direction and management of the previous owners, Mr. W. H. Smith, Mr. F. Ainscow, and Mr. E. J. Byrne.

THERE IS A distinct improvement reported in the light castings industry in Scotland, which has had a considerable period of short-time working. Whether this improvement in the Falkirk and Bonnybridge district is attributable to a larger home demand or a revival of the export trade enjoyed by the industry in the past, is not quite clear, but probably it may be ascribed to both causes.

THE EXCLUSIVE RIGHT to manufacture certain machine-tools of Craven Bros. (Manchester), Limited, design has been given to Crossley Motors, Limited, one of the group of companies owned and controlled by Associated Commercial Vehicles, Limited. These machine-tools will be designated Craven-Crossley production. Craven Bros. will sell, instal, and service them in all parts of the world.

THE CLYDE PLEASURE STEAMER Glen Sannox, which has carried hundreds of thousands of holidaymakers between Ardrossan and the Arran pier, left Greenock on July 28 on what is expected to be her last voyage. She has been sold to a Belgian firm which, it is understood, intends her for the breakers' yard. The tow to the Belgian port of Ghent is being undertaken by the deep-sea tug Turmoil, of Flying Enterprise fame.

AN ESTIMATE of the probable cost of an initial plant on Ungava Bay, Canada, capable of producing 1,000,000 tons of iron concentrate annually is being sought from the Battelle Memorial Institute, Columbus, Ohio, USA, by Fenimore Iron Mines. It is expected that approximately 200,000,000 tons of the estimated 1,000,000,000 tons of iron-bearing material on the two concessions at Ungava can be mined by open-cast methods.

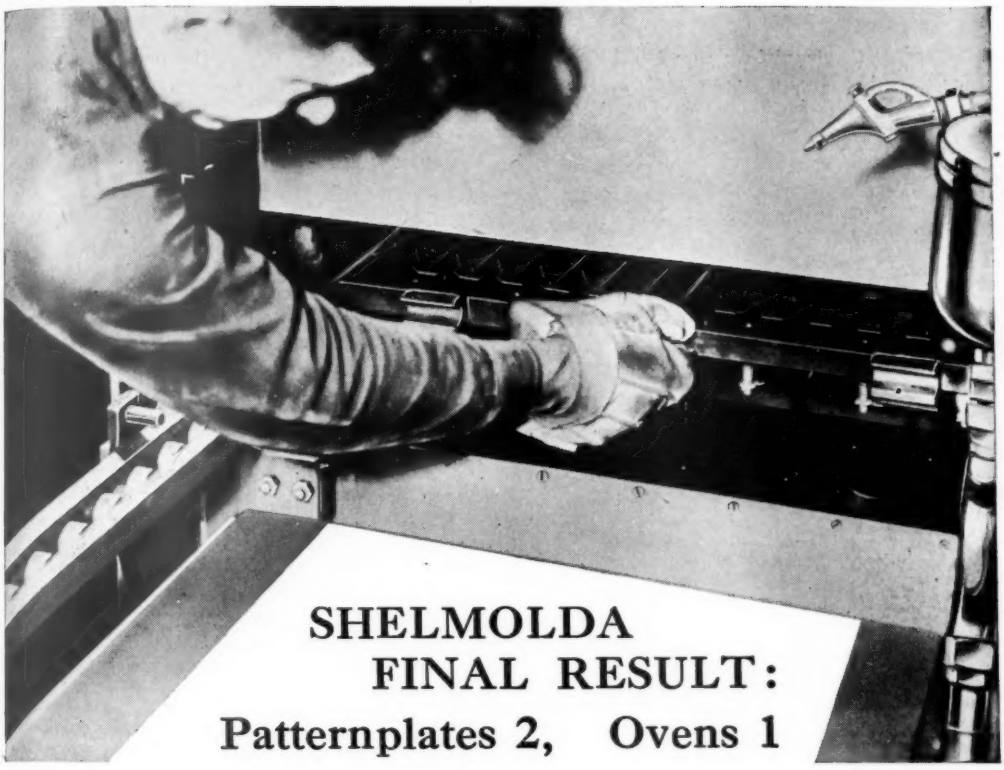
OUTPUT of iron and steel in France for June showed further increases: 880,000 tons of raw steel were produced, compared with 845,000 tons in May, and 912,000 tons in June, 1953. The June output of pig-iron, at 720,000 tons, passed the May figure of 696,000 tons, but was below the 772,000 tons produced in the corresponding month of last year. Estimates for this month have been enhanced by reports of an expansion in home and export orders.

THE POSSIBILITY of establishing a ferro-manganese industry in India is being examined. Manganese ore is India's biggest earner of foreign exchange as far as minerals are concerned. The bulk of the ore is consumed in the manufacture of ferro-manganese in the United States and in Great Britain. It is argued that if the ore were processed into ferro-manganese before export, India's earnings would be many times more than she obtains for the raw ore.

ACME CONVEYORS LIMITED, 181-3, Knightsbridge, London, S.W.7, have found it necessary to take additional premises to house their technical and development staff. New offices have been procured at 22, Hans Road, S.W.7, and Mr. George Taylor has joined the company as technical manager to supervise the work of these sections. Another addition to the staff is Mr. John Olivere, who has taken up duties as sales manager operating from the head office.

THE BRITISH OXYGEN COMPANY exhibit at the S.B.A.C. Flying Display, Farnborough, September 6 to 12, will in the main be devoted to the use of

Continued on page 192



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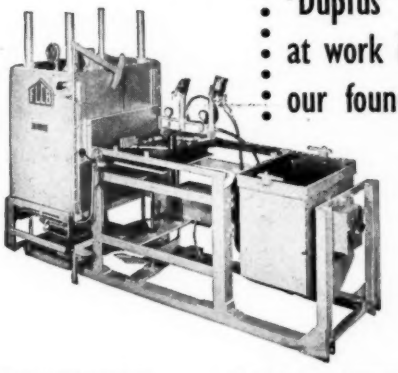

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News in Brief

Continued from page 190

liquid oxygen as a fuel oxidant for powering rocket engine applications, and the display will include photographs and models showing the types of plant used to produce liquid oxygen, also storage tanks and transport vehicles. Other exhibits include photographs and examples of equipment for Argon-arc welding processes.

CANADIAN pig-iron production during May totalled 178,742 tons, compared with 271,461 tons in the previous May. Steel ingot production fell from 358,896 tons to 252,988 tons, and the output of steel castings declined to 7,363 tons from 10,071 tons. In the first five months of the year pig-iron production amounted to 970,861 tons, against 1,221,404 tons last year. Steel ingot production fell from 1,723,649 tons to 1,290,627 tons, while steel castings declined from 47,294 tons to 40,621 tons.

THE MINISTER OF SUPPLY has made an Order confirming a scheme for the provision of funds for the Iron and Steel Board, under Section 13 of the Iron and Steel Act, 1953. The Board submitted the scheme to the Minister on June 4, 1954, and, as required by Section 13 (4) of the Act, published a notice that this had been done on the same day. The Order, The Iron and Steel Board Scheme for Provision of Funds Confirmation Order, 1954, S.I. 1954, No. 1012, came into effect on August 1 and is on sale at Her Majesty's Stationery Office.

THE WHITECHAPEL FOUNDRY, where Big Ben at Westminster and Big Tom at St. Paul's, were cast, was also responsible for the 12 bells which have recently been rehung in St. Giles Church, Cripplegate, where Oliver Cromwell was married. This 400-year-old foundry has a full programme on hand. It is to cast bells for several London churches, including St. Olave's, Hart Street (where Pepys worshipped), and St. Andrew Undershaft. Bells are also about to be shipped from the foundry to West Africa, Australia, New Orleans and Mauritius. The bells of Bow are kept in the foundry yard of these historic old premises.

MR. S. J. WEST, of Catcliffe, near Rotherham, was awarded £1,400 damages and costs by Mr. Justice Pilcher, in the Queen's Bench Division on July 30 for injuries sustained when working as a bricklayer for Steel, Peech & Tozer, a branch of the United Steel Companies, Limited. He was working at the Catcliffe works when brickwork fell on him. He alleged negligence by the firm in not providing a safe system of work, which was denied by the firm. Mr. Justice Pilcher said the firm should have provided a scaffold which would have enabled the man to work in safety. A stay of execution was granted while the question of an appeal was considered.

INDUSTRIAL AND SCIENTIFIC RESEARCH will be the subject of an exhibition to be held in Kelvingrove Museum in connection with the Scottish Industries' Exhibition. The exhibition is being organized by Dr. S. M. K. Henderson, Director of Museums in Glasgow, in co-operation with the D.S.I.R. Equipment from many industrial research laboratories will be on view, including some from Government research establishments and the universities. Through the exhibition, Scottish people will have the opportunity of witnessing developments in several fields of industry for the first time. Items on view will include instruments for detecting failures in metal and the moisture content of various materials, and an electron microscope; many of the exhibits will be seen in operation.

Midland Ironfounders' Association

Grave concern at the increasing cost of pig-iron, coke and coal was expressed on Thursday last by representatives of 500 ironfounders. The Midland Ironfounders' Association, representing founders in Staffordshire, Shropshire and Birmingham, has, through its executive committee, called for a halt to price increases in fuel and raw materials. Mr. R. Forbes Baird, secretary of the Midland Association and director of the Ironfounders' National Confederation, said: "The time has come to protest in the strongest possible terms and for attention to be drawn to the disastrous effects these increases will have on the national economy by virtue of the repercussions on home and export markets."

The executive of the Midland Ironfounders' Association has passed a resolution deploring the increases in prices of raw materials and urging Mr. Geoffrey Lloyd, Minister of Fuel, and Mr. Duncan Sandys, Minister of Supply, to safeguard the trade against any further increases.

It was stated at the executive meeting that a responsible leader of the miners had very recently voiced an opinion that the price of coal should be increased. Members felt that if this action were permitted by the Minister of Fuel, it would be the last straw, as in turn the cost of coke, pig-iron and rail transport would be automatically increased. This would probably mean that a number of iron foundries would go out of business, because certain industries had definitely made up their minds that they would not tolerate any further advance in the price of castings. Foundries were at present being pressed to reduce prices in order that their customers could obtain export orders.

One member referred to the machine-tool industry which was faced with serious competition from Germany; as vast quantities of castings were supplied to this industry, the result of a further price increase might well mean the loss of orders and consequent unemployment. The foundry industry was doing its best to operate efficiently, and apart from one small advance recently had not increased prices for over two years.

The executive considered that if other industries played their part in stabilizing prices there was a chance that manufacturers in the general engineering trade would be able to retain the business they had striven for so many years to develop.

Latest Foundry Statistics

According to the Bulletin of the British Iron and Steel Federation employment as at June 5 in steel foundries totalled 19,997 as compared with 20,101 in May and 20,843 a year ago. The weekly average production of steel castings during May was 5,900 tons as against 5,800 tons a year earlier. Of this quantity, 1,600 tons was of alloyed quality.

B.S.C.R.A. Director accepts New Position

A.P.V.-Paramount Limited, announce that Mr. J. F. B. Jackson, B.Sc., A.R.I.C., F.I.M., is shortly to join their Board as director in charge of their new foundries producing castings in special steels and non-ferrous alloys, that were opened at Crawley, Sussex, early last year. Mr. Jackson, an authority of international reputation on steel castings, will relinquish his position as director of the British Steel Castings Research Association in order to take up this new appointment.

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Raw Material Markets

Iron and Steel

Pig-iron production is not yet in balance. The firing of the new blast furnace at Scunthorpe will reduce, but not entirely bridge, the gap between the supply of basic iron and steel making demands. It is significant, also that, in spite of holiday stoppages, iron-foundries are now covering their forward requirements, and the engineering foundries are in still more urgent need of low-phosphorus and hematite irons. Some of these establishments have remained open during the holiday period for the acceptance of deliveries from the blast furnaces.

The supply of high-phosphorus iron is reasonably adequate.

Steelmakers are well able to cope with the current demand for semi-finished material, but the conditions in the re-rolling industry have undergone a distinct improvement during the past few weeks. A revival of the export trade in small bars and light sections has synchronized with the development of a more active home demand, and increased consumption of billets is foreshadowed. Even more favourable is the outlook in the sheet trade. Already it is suggested that the export quotas will have to be increased and in any event the mills are so busy that maximum tonnages of short bars and slabs will be required.

A cheery optimism is the keynote in all branches of the finished steel trade. Large sums are being spent on capital development, all the big shipbuilders are working to capacity; substantial engineering contracts are in hand; requirements for railway rolling stock and reconstruction are particularly heavy, and orders in hand afford the strongest possible incentive for the further expansion of rolling mills activity. An outstanding feature of the steel trade at present is the flow of orders for heavy sections and joists. Some of the mills are already booked to the end of the year. Demand for light plates has also increased, and tube-makers have an impressive weight of orders on their books.

Non-ferrous Metals

Monday of last week saw a fairly general start-up in the rolling mills after the holiday, and consumption of the non-ferrous metals, which had fallen to a low ebb, will now improve again. The outlook is promising, for manufacturers are believed to have good order-books which should assure them of plenty of work for some time to come, and in these circumstances it would hardly seem likely that much ground will be lost by metal values during the coming weeks. In saying this it is borne in mind that the quotations of all four metals traded at the Metal Exchange have fallen during the past two or three weeks, but last week, although fluctuations were seen, brought a somewhat steadier tone, and the close of trading on Friday was not without some promise of higher prices later. Actually lead staged a recovery, for first half August was up by £2 5s. and first half November by £1 10s. Zinc, however, lost ground, although it closed above the worst at £74 10s. sellers of August, the contango being only 5s. On balance, the early position was down by 15s. and forward by 25s. No change was made in the U.S. price at 11 cents. Tin gave way, probably due to the expectation that the maximum permitted price under the international agreement would be reduced from £880 to £840, and at the close was £5 10s. down for cash and £6 lower for three months. The decline in tin, influenced by a fall in the eastern price, continued after the weekend, but was checked yesterday (Wednesday).

Copper fluctuated daily, finally closing at the unofficial session on Friday afternoon unchanged for the cash position, but £1 down for three months, with a backwardation of £1 15s. While the day-to-day weakness of the cash position could be ascribed to selling on account of a U.K. intake of Chilean copper, the weakness of the three months position was rather surprising as there has not been any indication of values giving way in the States. Last Friday brought an announcement from the Metal Exchange that the new contract in standard copper will function from October 4 in three months metal and in cash after January 3 next. As already stated, the basis of trading will be in warehouse. Not everybody is convinced that the step taken by the Metal Exchange will turn out well, as there are fears that the amount of copper tendered to the market will decline.

Last week brought an announcement that the U.S. price of aluminium had been advanced by ½ cent to 22 cents per lb., equal to about £176. This compares with £156 in the U.K.

Official metal prices were as follow:—

COPPER, Standard—*Cash:* August 5, £234 15s. to £235; August 6, £233 to £233 10s.; August 9, £234 to £234 10s.; August 10, £234 5s. to £234 10s.; August 11, £234 5s. to £234 15s.

Three Months: August 5, £233 5s. to £233 10s.; August 6, £232 10s. to £232 15s.; August 9, £232 15s. to £233; August 10, £233 2s. 6d. to £233 5s.; August 11, £233 5s. to £233 10s.

TIN, Standard—*Cash:* August 5, £746 to £747; August 6, £742 to £742 10s.; August 9, £729 to £730; August 10, £726 to £727; August 11, £727 to £728.

Three Months: August 5, £743 to £744; August 6, £738 to £739; August 9, £729 to £730; August 10, £725 to £726; August 11, £727 to £728.

ZINC—*August:* August 5, £74 5s. to £74 10s.; August 6, £74 2s. 6d. to £74 5s.; August 9, £74 15s. to £74 17s. 6d.; August 10, £74 to £74 5s.; August 11, £74 to £74 5s.

First half November: August 5, £74 12s. 6d. to £74 17s. 6d.; August 6, £74 10s. to £74 15s.; August 9, £75 to £75 2s. 6d.; August 10, £74 12s. 6d. to £74 15s.; August 11, £74 7s. 6d. to £74 10s.

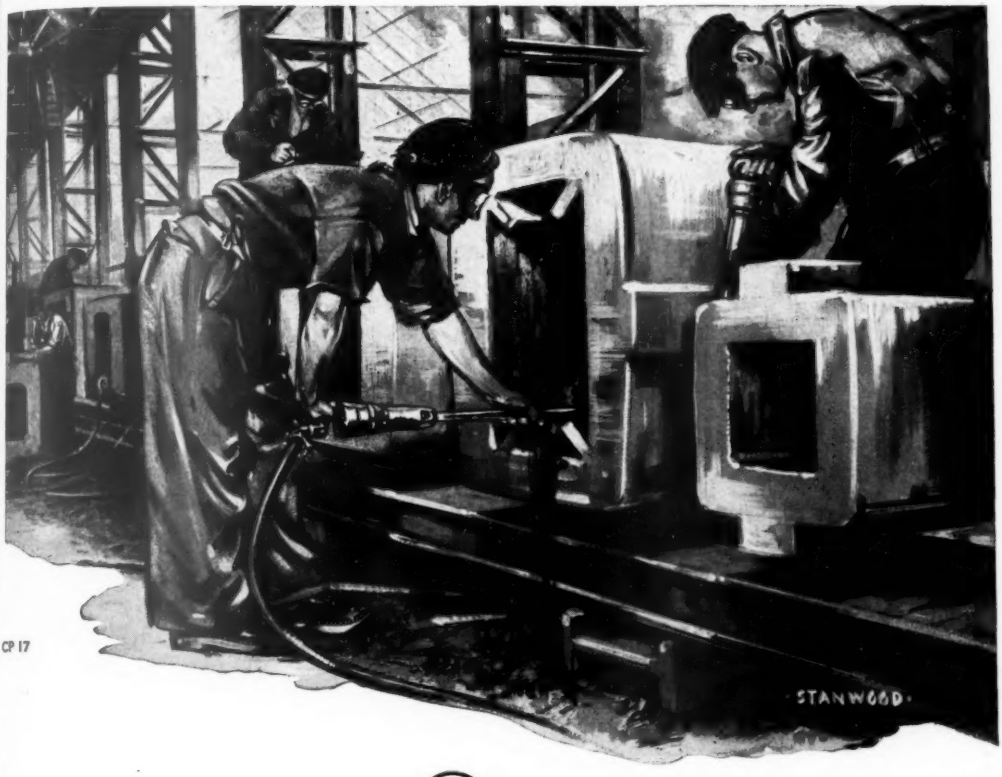
LEAD—*First half August:* August 5, £94 5s. to £94 10s.; August 6, £94 5s. to £94 10s.; August 9, £94 15s. to £95; August 10, £96 to £96 10s.; August 11, £96 15s. to £97.

First half November: August 5, £92 10s. to £92 15s.; August 6, £92 10s. to £92 12s. 6d.; August 9, £92 15s. to £93; August 10, £93 15s. to £94; August 11, £94 to £94 5s.

Scrap from Scapa Flow

Nearly 2,000 tons of scrap, including copper and brass, has been raised in Scapa Flow during recent months. The salvage operations are being carried out by a 60-ton floating crane and the tug Metinda III, belonging to Metal Industries, Limited. Work is now in progress on the hulks of the sunk blockships Thames and Numedian lying alongside the first barrier of the Churchill Causeway in Holm Sound.

These ships were sunk during the first world war as a defence against U-boats, but have not been required since the construction of the one-mile concrete causeway which now seals the eastern approach to Scapa Flow. A 25-ton boiler raised from the Numedian is now lying on Scapa Pier being cut up in readiness for shipment. There is still some salvage work to be done on the German Grand Fleet, which was scuttled in 1919 at the other side of the Flow.



MORE OUTPUT WITH CP TOOLS IN THE FOUNDRY

It is probably only the foundry workers themselves who can describe the perfect balance and control so characteristic of CP Chipping Hammers, but it is the whole foundry which benefits from the extra output and better workmanship that CP tools help them to achieve. And the same applies to CP Grinders, particularly Hicycle Electric Grinders which so many up-to-date foundries are installing as a means to lower costs and higher production.

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Current Prices of Iron, Steel, and Non-ferrous Metals

(Delivered unless otherwise stated)

August 11, 1954

PIG-IRON

Foundry Iron.—No. 3 IRON, CLASS 2:—Middlesbrough, £14 19s. 6d.; Birmingham, £14 12s. 9d.

Low-phosphorus Iron.—Over 0.10 to 0.75 per cent. P, £17 5s. 9d., delivered Birmingham. Staffordshire blast-furnace low-phosphorus foundry iron (0.10 to 0.50 per cent. P, up to 3 per cent. Si), d/d within 60 miles of Stafford, £17 16s. 9d.

Scotch Iron.—No. 3 foundry, £17 9s. 6d., d/d Grangemouth.

Cylinder and Refined Irons.—North Zone, £18 19s. 6d.; South Zone, £19 2s. 0d.

Refined Malleable.—P, 0.10 per cent. max.—North Zone, £19 19s. 6d.; South Zone, £20 2s. 0d.

Hematite.—Si up to 2 per cent., S. & P. over 0.03 to 0.05 per cent.:—N.-E. of England (local iron), £17 14s. 6d.; Scotland (Scotch iron), £18 1s. 0d.; Sheffield, £18 19s. 0d.; Birmingham, £19 6s. 6d.; Wales (Welsh iron), £18 1s. 0d.

Basic Pig-iron.—£15 10s. 6d. all districts.

FERRO-ALLOYS

(Per ton unless otherwise stated, delivered)

Ferro-silicon (6-ton lots).—40/55 per cent., £42 0s. 0d., basis 45 per cent. Si, scale 17s. per unit; 70/84 per cent., £65 0s. 0d., basis 75 per cent. Si, scale 18s. per unit.

Ferro-vanadium.—50/60 per cent., 23s. 8d. to 25s. 0d. per lb. of V.

Ferro-molybdenum.—65/75 per cent., carbon-free, 10s. 0d. per lb. of Mo.

Ferro-titanium.—20/25 per cent., carbon-free, £185 0s. 0d. to £195 0s. 0d. per ton; 38/40 per cent., £251 0s. 0d. to £270 0s. 0d. per ton.

Ferro-tungsten.—80/85 per cent., 14s. 0d. per lb. of W.

Tungsten Metal Powder.—98/99 per cent., 17s. 0d. per lb. of W.

Ferro-chrome (6-ton lots).—4/6 per cent. C, £75 0s. 0d. to £80 0s. 0d., basis 60 per cent. Cr, scale 25s. 0d. per unit; over 6 per cent. C, £74 0s. 0d. to £76 0s. 0d., basis 60 per cent. Cr, scale 24s. 0d. per unit; max. 2 per cent. C, 1s. 7½d. per lb. Cr; max. 1 per cent. C, 1s. 8d. per lb. Cr; max. 0.15 per cent. C, 1s. 9½d. per lb. Cr; max. 0.10 per cent. C, 1s. 9¾d. per lb. Cr; max. 0.06 per cent. C, 1s. 10d. per lb. Cr.

Metallic Chromium.—98/99 per cent., 6s. 6½d. to 7s. 1d. per lb.

Metallic Manganese.—93/95 per cent., carbon-free, £225 0s. 0d. to £232 0s. 0d. per ton; 96/98 per cent., £255 0s. 0d. to £262 0s. 0d. per ton.

Ferro-columbium.—60/75 per cent., Nb + Ta, 52s. 6d. to 70s. 0d. per lb., Nb + Ta.

SEMI-FINISHED STEEL

Re-rolling Billets, Blooms, and Slabs.—BASIC: Soft, u.t., £25 12s. 6d.; tested, 0.08 to 0.25 per cent. C, £26 12s. 6d.; hard (0.41 to 0.60 per cent. C), £28 0s. 0d.; silico-manganese, £33 16s. 0d.; free-cutting, £28 16s. 6d. SIEMENS MARTIN ACID: Up to 0.25 per cent. C, £32 12s. 0d.; silico-manganese, £34 17s. 6d.

Billets, Blooms, and Slabs for Forging and Stamping.—Basic, soft, up to 0.25 per cent. C, £29 16s. 0d.; basic, hard, over 0.41 up to 0.60 per cent. C, £30 16s. 0d.; acid, up to 0.25 per cent. C, £33 0s. 0d.

FINISHED STEEL

Heavy Plates and Sections.—Ship plates (N.-E. Coast), £31 1s. 6d.; boiler plates (N.-E. Coast), £32 9s. 0d.; floor plates (N.-E. Coast), £32 10s. 6d.; sectional material, N.-E. Coast, £29 4s. 6d.

Small Bars, Sheets, etc.—Rounds and squares, under 3 in., untested, £32 7s. 0d.; flats, 5 in. wide and under, £32 7s. 0d.; hoop and strip, £33 9s. 0d.; black sheets, 17/20 g., £42 1s. 0d.; galvanized corrugated sheets, 24 g., £51 8s. 6d.

Alloy Steel Bars.—1 in. dia. and up: Nickel, £53 8s. 0d.; nickel-chrome, £75 2s. 0d.; nickel-chrome-molybdenum, £84 13s. 6d.

NON-FERROUS METALS

Copper.—Cash, £234 5s. 0d. to £234 15s. 0d.; three months, £233 5s. 0d. to £233 10s. 0d.; settlement, £234 15s. 0d.

Copper Tubes, etc.—Solid-drawn tubes, 27½d. per lb.; wire, 263s. 6d. per cwt. basis; 20 s.w.g., 294s. 9d. per cwt.

Tin.—Cash, £727 0s. 0d. to £728 0s. 0d.; three months, £727 0s. 0d. to £728 0s. 0d.; settlement, £728 0s. 0d.

Zinc.—August, £74 0s. 0d. to £74 5s. 0d.; first half November, £74 7s. 6d. to £74 10s. 0d.

Zinc Sheets, etc.—Sheets, 15 g. and thicker, all English destinations, £105 2s. 6d.: rolled zinc (boiler plates), all English destinations, £102 17s. 6d.; zinc oxide (Red Seal), d/d buyers premises, £96 0s. 0d.

Lead (Refined Pig).—First half August, £96 15s. 0d. to £97 0s. 0d.; first half November, £94 0s. 0d. to £94 5s. 0d.

Brass Tubes, etc.—Solid-drawn tubes, 22½d. per lb.; rods, drawn, 32½d.; sheets to 10 w.g., 256s. 0d. per cwt.; wire, 30d.; rolled metal, 242s. 3d. per cwt.

Brass (Brazing).—BS1400, B3 (65/35), £164; B6 (85/15), £199; BS249, £178.

Brass (High Tensile).—BS1400, HTB1 (30 tons), £202; HTB2 (38 tons), £210; HTB3 (48 tons), £220.

Gunmetal.—RCH, 3/4 per cent. tin, —; BS1400, LG2 (85/5/5/5), £199; LG3 (86/7½/5/2), £208; G1 (88/10/2/½), £280; (88/10/2/1), £269.

Phosphor Bronze.—BS1400, PB1 (AID released), £290 per ton.

Phosphor Bronze Strip, etc.—Strip, 363s. 3d. per cwt.; sheets to 10 w.g., 385s. 9d. per cwt.; wire, 45½d. per lb.; rods, 39½d.; tubes, 37¾d.; chill cast bars: solids 40d., cored 41d. (CHARLES CLIFFORD, LIMITED.)

Nickel Silver, etc.—Rolled metal, 3 in. to 9 in. wide × 0.056, 3s. 1¾d. per lb.; round wire, 10g., in coils (10 per cent.), 3s. 7d.; special quality turning rod, 10 per cent., ½ in. dia., in straight lengths, 3s. 6d. All prices are net.

Other Metals.—Magnesium, ingots, 2s. 3d. per lb. Antimony, English, 99 per cent., £210 0s. 0d. Quicksilver, ex warehouse, £100 0s. 0d. Nickel, £483 0s. 0d. Aluminium, ingots, £156 0s. 0d.; aluminium bronze (BS1400), AB1, £249; AB2, £260. Solder, brazing, BS1845, 1s. 11d. lb.; granulated, 2s. 2d. lb.

Company News

THORN ELECTRICAL INDUSTRIES, LIMITED—Group trading profit has increased by £283,056, or roughly 37 per cent., and a 7½ per cent. rise in the equity dividend is recommended. Group trading profits for the year ended March 31, amounted to £1,054,348, compared with £771,292. Net profit, subject to completion of audit, is £92,307 higher at £315,566.

JOHN SHAW & SONS WOLVERHAMPTON, LIMITED, tool makers and merchants, etc.—A 15 per cent. dividend is recommended on the £502,495 ordinary capital for the year ended March 31, as a year ago, but is payable on a capital raised from £334,996 by a 50 per cent. scrip issue and absorbs £41,456, against £27,637. Profits sharply expanded, the untaxed group balance of £360,445 comparing with £241,899 in the previous year. Tax absorbs £225,327 (£144,756), leaving a net profit of £135,118 (£97,143).

DAVY & UNITED ENGINEERING COMPANY, LIMITED—For the year ended March 31, a dividend is announced of 10 per cent., less tax, on the £1,083,715 one-class capital as raised by the previous 1-for-21 issue at par. The payment for 1952-53 was the same on £1,035,322 capital. Stockholders are now to be offered the right to subscribe at par for one new share for every £22 of stock held. Group trading profit, including sundry income, amounted to £551,742, compared with £443,138 for the previous year.

WELLMAN SMITH OWEN ENGINEERING CORPORATION, LIMITED—For 1953-54 a final dividend on £650,000 ordinary capital of 12½ per cent., making 20 per cent., is recommended, and capitalization of £50,000 from general reserve to make a free issue of one new ordinary £1 share for every £13 stock held. Resolutions to effect this will be submitted at the forthcoming annual meeting. A final of 10 per cent., to make 17½ per cent. on £600,000, was paid last year. Net manufacturing and trading profits of group, after providing for taxation, amount to £227,702, against £228,312 in the previous year.

SIMON-CARVES, LIMITED, coke-oven and coal-washing plant manufacturers, etc., of Stockport (Ches.)—Trading profits after adjustment of special provision for retention balances on completed contracts, amounted to £616,112 for 1953, compared with £760,695 for the previous 12 months. The net taxed balance is lower by £115,422 at £163,784, against which the cost of the year's 20 per cent. dividend, comprising interim 12½ per cent. and a recommended final of 7½ per cent., is £51,899, compared with the £45,554 taken by the previous year's similar rate. Of the 1952 carry-forward a sum of £43,385 has been capitalized.

EDGAR ALLEN & COMPANY, LIMITED, steelmakers, engineers, and founders, of Sheffield—Group profits are lower, but the equity distribution is raised. After tax of £292,944 (£403,861), and after special credits of £6,440 (nil), group net profit for the year to April 4, 1954, has decreased from £265,199 to £246,361. The untaxed profits fell by £129,755 to £539,305. The recommended 20 per cent. dividend compares with 15 per cent., including 5 per cent. bonus. The 1952-53 payments were on capital of £861,890, as doubled by a 100 per cent, free scrip issue. Net cost of £94,808 goes against £71,106 for 1952-53. Turnover has been maintained almost at the previous year's figure, but increased costs of materials and labour, reduction in selling prices, and changes in the incidence of demand for the company's products have together contributed to reduce the overall ratio of profit earned.

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NOTICE

Replies to Box Numbers to be addressed to "Foundry Trade Journal," 49, Wellington Street, London, W.C.2.

SITUATIONS WANTED

YOUNG FOUNDRY MANAGER (33), well educated, keen and energetic, technically trained by well-known firm, City and Guilds, A.I.D. radiologist, successful practical experience starting prosperous grey iron and non-ferrous jobbing foundry, floor, plate, machine moulding, estimating, costing, buying, customer liaison, etc., used full control, seeks progressive situation.—Box YF652, FOUNDRY TRADE JOURNAL.

REPRESENTATION required by experienced and fully trained Foundryman, to cover the Southern half of England. Thorough practical and technical knowledge of trade. Capable of working on own account. Interested in foundry supplies, metals, ferrous and non-ferrous, Machinery, and general equipment.—Box RR610, FOUNDRY TRADE JOURNAL.

FOUNDRY MANAGER, 30 years' experience iron foundries, including rolls, A.I.M., capable of taking complete charge, requires similar position, or would consider representation for Castings or Foundry Materials.—Box FM689, FOUNDRY TRADE JOURNAL.

SITUATIONS VACANT

The engagement of persons answering these advertisements must be made through a Local Office of the Ministry of Labour or a Scheduled Employment Agency if the applicant is a man aged 18-64 *inclusive or a woman aged* 18-59 *inclusive unless he or she, or the employment, is excepted from the provisions of the Notification of Vacancies Order,* 1952.

STEEL FOUNDRY CHEMIST, with experience of Tropenas process. State age, experience, and salary required.—Box SF693, FOUNDRY TRADE JOURNAL.

ASSISTANT METALLURGIST required by large Ironfounders in the Falkirk area. Must have experience in Cupola and Sand Control, and possess a knowledge of metallurgncal analysis. Must also have completed National Service.—Box AM683, FOUNDRY TRADE JOURNAL.

ASSISTANT ENGINEER required by Foundry Plant Manufacturers in the Midlands, capable of controlling Drawing Office, visiting sites, preparing schemes in connection with melting plant, mechanical handling and structural work. This is an executive post offering scope with a progressive organisation. Present staff notified of this vacancy.—Please send full details, in confidence, to PERSONNEL MANAGER, Box AE690, FOUNDRY TRADE JOURNAL.

TECHNICAL Sales Representative for the sale and servicing of Shell Moulding Equipment in the Midlands area. Age about 30, well educated and with pleasant sales personality, preferably with good foundry background. Please state in confidence fullest possible details of education, experience, etc. Our staff have been notified of this appointment. Box TS674, FOUNDRY TRADE JOURNAL.

SITUATIONS VACANT—*contd.*

A PROGRESSIVE Company in Central Scotland requires a young FOREMAN with good technical background and sound practical experience in the production of ferrous or non-ferrous castings. Superannuated Staff position.—Reply, state age, qualifications and salary required, to Box AP686, FOUNDRY TRADE JOURNAL.

MECHANIC required, with experience of "B.M.M." moulding machines, to service an installation of 32 Turnover and Straight draw type machines in a South African Foundry.—Replies to Box MR685, FOUNDRY TRADE JOURNAL.

SALES OFFICE ESTIMATOR required for Steelfoundry.—Apply in writing, giving full details of experience, etc., Box SO643, FOUNDRY TRADE JOURNAL.

APPLICATIONS are invited for the position of PATTERN SHOP SUPERINTENDENT for modern Steel Foundry. Experience essential both wood and metal patterns for close limit work. Applicant must be good disciplinarian, and capable of maintaining a consistent high standard of workmanship.—Apply, giving details of training, experience, and salary required, to Box AA684, FOUNDRY TRADE JOURNAL.

IRON FOUNDRY FOREMAN required for small Foundry attached to a large Engineering Works in the North-East Midlands.

The work covers Green Sand, Dry Sand, and a little loam and Machine Moulding. Output per week between 7 and 10 tons.

The post would be suitable for a good all round practical man between 45 and 50 years of age who requires steady employment not overburdened with anxiety.

The vacancy is due to retirement and is a pensionable appointment.

Write, giving age, particulars of experience, and salary required, to Box IF682, FOUNDRY TRADE JOURNAL.

JOBBING MOULDERS required, London shop; also CUPOLA FURNACEMAN.—Apply PLANT, MACHINERY & ACCESSORIES, LTD., 136/140, Bramley Road, W.10.

IRON MOULDERS.

EXCELLENT money can be earned by first-class workmen who have served apprenticeship, and are capable of thinking for themselves and doing good jobs quickly.

Only those who have had extensive experience of general engineering, machine tool, large electrical industry castings need apply. Preference those who have experience of production by Sandslinger.

MACHINE MOULDERS, FETTLERS and Skilled FOUNDRY LABOURERS also wanted.

High upstanding rates paid, plus bonus, according to skill and experience.

Box IM691, FOUNDRY TRADE JOURNAL.

FULLY experienced CORE SHOP FOREMAN required for modern Mechanised Foundry. Experience in rate fixing would be an advantage. This is a pensionable Staff appointment.—Applications to GOULDS FOUNDRIES, LTD., Tredegar Foundry, Newport, Mon.

SITUATIONS VACANT—*contd.*

MOULDERS and COREMAKERS for Iron Foundry in Slough. Good conditions, rates, and payment by results.—Apply Box MC688, FOUNDRY TRADE JOURNAL.

METALLURGIST required for Foundry and Works Control. Foundry experience necessary. Age 25 minimum.—Write, giving qualifications, to TECHNICAL MANAGER, Deloro Stellite, Ltd., Highlands Road, Shirley, Birmingham, marked "confidential."

FOREMAN PATTERNMAKER required for Midlands. Must be first class wood and metal man, able to estimate and check, and to control labour. Good technical and general education. Permanent position for suitable applicant. State age, salary at present received and required, and full details of experience. Box FP670, FOUNDRY TRADE JOURNAL.

A TECHNICAL REPRESENTATIVE is required by Bagshawe & Company Limited, Dunstable Works, Dunstable, to handle sales of malleable iron castings. Previous experience of foundry sales and/or some practical foundry experience will be an advantage. Applications, which will be treated in confidence, must state full details of experience and salary required.

LARGE integrated old-established steel plant overseas invite applications for the following senior position:

A practical FOUNDRY SUPERINTENDENT. To take charge of large Foundry producing ferrous and non-ferrous castings. Must know all phases of Foundry operation and management, with thorough knowledge of steel, iron and non-ferrous foundry practice.

Age not over 50.

Salary according to qualifications and experience.

The appointment would be on the basis of 3-year contract, air passage outward and sea passages homeward journeys for self, wife and two children, service bonus and profit sharing bonus and free medical treatment.

Write, in duplicate, giving full particulars of age, education, qualifications and experience, to Box No. 7897, c/o CHARLES BARKER & SONS, LTD., 31, Budge Row, London, E.C.4.

FOUNDRY MANAGER required with sound Metallurgical knowledge. Applicants having good Foundry experience only will be considered This position offers first class opportunities to men with initiative and drive. Apply in writing, giving particulars and salary required to Box FM667, FOUNDRY TRADE JOURNAL.

VACANCY in Scottish Non-ferrous Foundry for experienced FOUNDRY SUPERVISOR. Must have full knowledge all classes work, including Al. Bronze, Aluminium, Nickel Alloys. Nice house available. Prospects and salary in keeping with experience and ability to produce results. Exceptional chance for younger man who is looking for opportunity to advance quickly in progressive firm.—Box VI680, FOUNDRY TRADE JOURNAL.

EXPERIENCED and capable man required for Progress Office in Ironfoundry. Croydon area.—Box EA681, FOUNDRY TRADE JOURNAL.

SALES REPRESENTATIVE required by Refractory Manufacturers for Birmingham area. Experience of foundry trade desirable. Please write in confidence, stating experience and remuneration required.—Box SR673, FOUNDRY TRADE JOURNAL.